PRELUDE FLNG

ENVIRONMENT PLAN 2025

INPEX KOGAS OPIC

Prelude FLNG Environment Plan

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1 Environment Plan Summary Statement

This Prelude Environment Plan (EP) summary has been prepared from material provided in this EP. The summary comprises the following as required by Section 35(7)(a) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) regulations 2023 (Cth) (OPGGS(E) regulations):

EP Summary material requirement	Relevant section of this EP
The location of the activity	Section 6.2
A description of the receiving environment	Section 7
A description of the activity	Section 6
Details of the environmental impacts and risks	Section 8
The control measures for the activity	Section 9
The arrangements for ongoing monitoring of the titleholders environmental performance	Section 9
Response arrangements in the oil pollution emergency plan	Section 9
Consultation already undertaken and plans for ongoing consultation	Section 5
Details of the titleholders nominated liaison person for the activity	Section 6.5 and Section 10.13

2 Introduction

The Prelude Floating Liquefied Natural Gas (FLNG) Facility (Prelude) (EPBC 2008/4146) is operated by Shell Australia Pty Ltd ("Shell" as a subsidiary of Shell plc, which is a member of the Shell Group of Companies (in this EP, references to global activities use the term 'Shell Group')). The Prelude FLNG 'Activity Area' is located in Commonwealth waters in the northern Browse Basin, 200 kilometres (km) offshore northwest Australia and 460 km north-north east of Broome in water depth of ~250 Metres (m) (Figure 2-1). Shell is the Titleholder and Operator of the Prelude FLNG in joint venture with INPEX, KOGAS and OPIC.

Prelude comprises the facility itself and subsea systems including: production wells and manifolds; flowlines; riser base manifolds; flexible risers that transport the gas, condensate and any produced formation water to the facility; and umbilicals used to control the wells and associated equipment.

The Prelude FLNG Project was referred by Shell under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) ("EPBC Act") which is further addressed in Section 3.2.2. The scope of this EP covers:

- Production and Operations within the designated safety zone, including product offtake tankers or bunkering vessels only when they are attached to Prelude FLNG (considered as petroleum activities)
- Maintenance and turnarounds of the facility and subsea production system
- Significant modifications of the facility
- Well intervention using a Light Well Intervention (LWI) vessel
- Emergency Response events.

This EP is prepared in accordance with the OPGGS(E) Regulations and describes the following:

- The environmental management framework for the activity including legislation and other requirements (Section 3)
- Shell's Health, Security, Safety and Environment and Social Performance (HSSE and SP) Commitment and Policy and the environmental performance objectives that derive from the Policy (Section 4.2)
- The consultation process undertaken with relevant persons and the associated resolution of and/or responses to any objections or claims (Section 5)
- The area of operations, the proposed activities, and its expected time frame (Section 6)
- The existing physical, natural, social and economic environments of the region, including issues or sensitivities particular to the activity (Section 7)
- The framework defining acceptable levels of impacts and risks (Section 8)
- The impacts and risks to the environment from both planned (normal) and unplanned (abnormal) operations, and the Environmental Performance Outcomes (EPOs), Environmental Performance Standards (EPSs) and Measurement Criteria (MC) against which environmental performance is measured (Section 9)
- The Implementation Strategy, including key roles and responsibilities that are employed to achieve the program's environmental performance goals1 (Section 10)
- A system for documenting, monitoring, reporting and reviewing the success of the Implementation Strategy to facilitate improvement of environmental performance and external reporting as required (Section 10).

[1] The Shell Browse Oil Pollution Emergency Plan (BROPEP) (HSE_GEN_016765), and the Browse Regional Operational and Scientific Monitoring Bridging Implementation Plan (HSE_PRE_016370) are presented as standalone documents, submitted together with this EP.

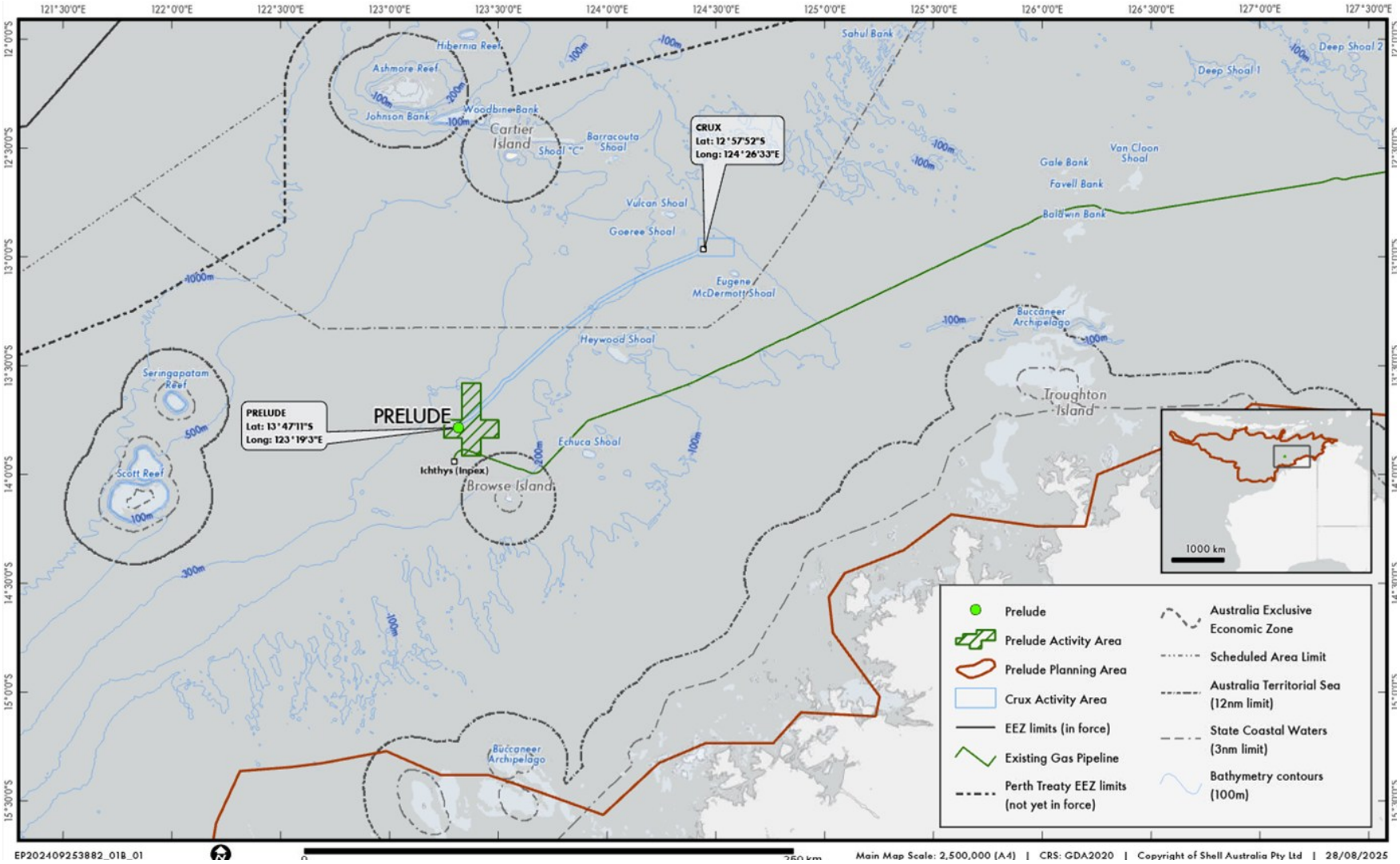


Figure 2-1: Indicative Location of Activity Area (Permit Area WA-44-L and WA-2-IL)

3 Requirements

This section is intended to fulfil the requirements of Section 21(4) of the OPGGS(E) Regulations and meet NOPSEMA's expectations stated in the EP Content Requirements Guidance Note (NOPSEMA 2025). Section 21(4) stipulates that an EP must:

(a) describe the requirements, including legislative requirements, that apply to the activity and are relevant to the environmental management of the activity; and

(b) demonstrate how those requirements will be met.

NOPSEMA does not expect that requirements that are not relevant to the environmental management of petroleum activities be included in the EP (NOPSEMA 2025).

These subsections are intended to meet the requirements stated above:

- Commonwealth policy (Section 3.1)
- Commonwealth legislation (Section 3.2)
- International agreement and conventions (Section 3.4)
- GHG Legislative Framework (Section 3.5).

3.1 Commonwealth Policy

3.1.1 Australia's Oceans Policy

Australia's Oceans Policy 1998 (CoA 1998) provides a framework for integrating environmental, economic, social, and cultural ocean uses. This policy details a comprehensive approach to exercising and protecting Australia's marine jurisdiction, and aims to:

- Fulfil Australia's obligations under the United Nations Conventions on the Law of the Sea 1982
- Understand and safeguard the marine environment
- Promote ecologically sustainable development (ESD) through integrated planning and management.

Under this policy, the federal, state and territory governments have established a system of Australian Marine Parks (AMPs) and state/territory reserves (such as state marine parks). These parks are managed using the principles of ESD (including multiple use), which balance conservation with economic activity.

The AMPs were established under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), and states and territories established their reserves under the National Representative System of Marine Protected Areas. Section 7.3.1 gives further information on AMPs management plans.

3.2 Commonwealth Legislation

Various Commonwealth legislation applies to the environmental management of petroleum activities. In the remainder of this section, each piece of legislation relevant to the environmental management of the petroleum activities is summarised. Links to various sections in this EP are also provided—these sections relate to how these legislative requirements were considered in the development of this EP.

The activities considered in this EP will take place entirely in Commonwealth waters; therefore, legislation relating to the environmental management of the petroleum activities considered in this EP are primarily Commonwealth Acts and their subsidiary legislation and regulations. The key Acts are the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) (OPGGS Act) (Section 3.2.1) and the EPBC Act (Section 3.2.2).

The Australian Government (Commonwealth) encourages investment in, and the development of, petroleum resources in Commonwealth waters. Offshore petroleum resources are regulated by NOPSEMA. The National Offshore Petroleum Titles Administrator (NOPTA) administers and manages oil, gas, and Greenhouse Gas (GHG) titles in accordance with the OPGGS Act. Together, NOPSEMA and NOPTA identify and release

prospective acreage, and grant, regulate, and surrender exploration and development titles. Additional Commonwealth legislation is considered in detail in Table 3-3.

State legislation that may apply to the environmental management of an emergency event is also detailed in Table 3-3.

3.2.1 Offshore Petroleum and Greenhouse Gas Storage Act 2006

The OPGGS Act provides the regulatory framework for petroleum exploration, production and GHG storage activities in Commonwealth waters. The OPGGS Act is supported by a range of subsidiary legislation, including the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2024 (OPGGS (Safety) Regulations) and the OPGGS(E) Regulations.

The OPGGS Act regulates all offshore petroleum activities, including decommissioning, under sections 572 and 270. Sections 10.5.8 and 10.5.13 describe the property maintenance and decommissioning planning, including ongoing asset management and maintenance, and decommissioning and removal strategy.

The OPGGS(E) Regulations (see Section 3.2.1.1) require the environmental impacts and risks of offshore petroleum and GHG storage activities be managed to a level that is acceptable and as low as reasonably practicable (ALARP).

3.2.1.1 Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023

The OPGGS(E) Regulations provide for the protection of the environment in Commonwealth waters by requiring that petroleum and greenhouse gas storage activities be managed in a way that:

- reduces the environmental impacts and risks of the activity to a level that is ALARP
- reduces the environmental impacts and risks of the activity to an acceptable level (see Section 8.2)
- is consistent with the principles of Ecologically Sustainable Development (ESD), as defined in Section 3A of the EPBC Act (see Section 8.1).

The method applied to assess environmental impacts and risks from the petroleum activities considered in this EP details how impacts and risks are managed to a level that is acceptable, ALARP and consistent with the principles of ESD. Sections 8, 9.1 and 9.2 of this EP describe this method, while Sections 9.3 to 9.15 detail aspect-specific demonstrations for each impact and risk assessment (RA).

Sections 21(2) and (3) of the OPGGS(E) Regulations require EPs to include details of relevant values and sensitivities of the environment that may be affected by the activity including Matters of National Environmental Significance (MNES) protected under the EPBC Act, including:

- the world heritage values of a declared World Heritage property
- the national heritage values of a National Heritage place
- the ecological character of a declared Ramsar wetland
- the presence of a listed threatened species or listed threatened ecological community
- the presence of a listed migratory species
- any values and sensitivities that exist in, or in relation to, part or all of:
  - a Commonwealth marine area
  - Commonwealth land.

Section 7 describes the MNES that may credibly be impacted or are at risk of being impacted and these are considered in the assessment of environmental impacts and risks.

Section 34 of the OPGGS(E) Regulations states the criteria for acceptance of an EP for an activity. Table 3-1 summarises these criteria and links to the sections in this EP that relate to each.

Table 3-1: Relationships between Section 34 of the OPGGS(E) Regulation Requirements and this EP

OPGGS(E) Regulation	Requirement	Relevant Section of EP
34(a)	The EP is appropriate for the nature and scale of the activity	Sections 6 and 10 detail the nature and scale of the petroleum activities considered within this EP. Section 7 describes the environmental receptors that may credibly be impacted, or are at risk of being impacted, by the planned activities and unplanned events. Sections 9.3 to 9.15 details the environmental impact and risk assessments based on the context provided by Sections 5 and 7 (as well as Shell's internal context and the context provided by relevant persons).
34(b)	The EP demonstrates that the environmental impacts and risks of the activity will be reduced to ALARP.	Sections 9.1 and 9.2 detail the method Shell uses to demonstrate that environmental impacts and risks are managed to a level that is ALARP. Aspect-specific ALARP demonstrations are detailed in the impact and risk assessments in Sections 9.3 to 9.15.
34(c)	The EP demonstrates that the environmental impacts and risks of the activity will be of an acceptable level.	Section 8 details the method Shell uses to demonstrate that environmental impacts and risks are managed to a level that is acceptable. Aspect-specific demonstrations of acceptability are detailed in the impact and risk assessments in Sections 9.3 to 9.15
34(d)	The EP provides appropriate environmental performance outcomes (EPOs), environmental performance standards (EPSs), and measurement criteria (MCs).	EPOs, EPSs, and MCs are detailed in Sections 9.3 to 9.15
34(e)	The EP includes an appropriate implementation strategy and monitoring, recording, and reporting arrangements.	Section 10 describes the implementation strategy for the EP.
34(f)	The EP does not involve the activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, being undertaken in any part of a declared World Heritage property.	Section 6 details the planned petroleum activities considered in this EP, none of which will occur within a World Heritage Area.
34(g)	The EP demonstrates that: (i) the titleholder has carried out the consultations required by Section 25; and (ii) the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate.	Section 5 and Appendix B detail the consultation undertaken in relation to the EP, including Shell's responses to any claims or objections made by relevant persons. Any management measures adopted in response to consultation outcomes are considered in the aspect-specific impact and risk assessments in Sections 9.3 to 9.15 and also within Sections 5, 7, 8 and 10.

OPGGS(E) Regulation	Requirement	Relevant Section of EP
34(h)	The EP complies with the Act, this instrument and any other regulations made under the Act.	Section 3.2.1 shows the relationship between the Act, regulations, and components of the EP.

3.2.2 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act and supporting regulations provide for the protection of the environment and the conservation of biodiversity in Australia. Amendments to the OPGGS Act and OPGGS(E) Regulations in February 2014, undertaken as part of the streamlining of environmental approvals for petroleum activities in Commonwealth waters, require impacts and risks to matters protected under Part 3 of the EPBC Act (i.e. MNES) be considered in an EP. Following the streamlining arrangements, NOPSEMA became the sole environmental regulator for petroleum activities (i.e. regulates activities under the OPGGS Act and EPBC Act) in Commonwealth waters.

The matters protected under Part 3 of the EPBC Act that are required by the OPGGS(E) Regulations are outlined above in Section 3.2.1. As part of the streamlining arrangements, matters protected under Part 3 of the EPBC Act must be considered by NOPSEMA when assessing an EP.

3.2.2.1 Consolidated Approval Conditions

The Prelude FLNG Project was referred for assessment under the EPBC Act in 2008 (EPBC 2008/4146) and was deemed to be a 'controlled action'. The Project was assessed through an Environmental Impact Statement (EIS), following which the Project was approved on 12 November 2010 subject to a series of conditions via approval decision EPBC 2008/4146. These conditions were varied on 8 September 2015 and the consolidated approval conditions subsequently published. The consolidated conditions, along with the associated sections of the EP relevant to the conditions, are provided in Table 3-2.

Table 3-2: EPBC Approval Conditions (EPBC 2008/4146) and related EP sections

Approval Conditions (EPBC 2008/4146)	Relevant EP Sections
1) The person taking the action must submit, for the Minister's approval, a plan (or plans) for managing the offshore impacts of the action. The plan (or plans) must include measures for: a) Production drilling activities: a) Well locations; b) Drilling fluid types and disposal method; c) Drill cutting disposal method; d) Fuel and chemical handling and transfer procedures; e) Cetacean interaction procedures for supply vessels and aircraft that are consistent with Part 8 of the *Environment Protection and Biodiversity Conservation Regulations 2000*; and f) Cetacean sightings reporting. b) Offshore construction and installation, including: a) Design and construction that allows for the complete removal of all structures and components above the seafloor during decommissioning; b) Details of the anchor type and placements, methods for connection of mooring lines, installation of the risers and flowline paths; c) Measures to minimise seabed disturbance; d) Hydrotest fluid type, handling and disposal methods; e) Cetacean interaction procedures for supply vessels and aircraft that are consistent with Part 8 of the *Environment Protection and Biodiversity Conservation Regulations 2000*; f) Cetacean sightings reporting; and g) Measures for reporting environmental incidents. c) Operations, including: a) Offtake tanker vetting procedures; b) Produced formation water and naturally occurring radioactive materials monitoring and management; c) Measures to reduce artificial lighting and noise associated with operation;	Shell has prepared, submitted for assessment and implemented EPs for all stages of the Prelude FLNG development to date. This EP relates only to the start-up and operations phases of the action or as amended from time to time. 1a) Production drilling activities are beyond the scope of the petroleum activities considered in this EP. 1b) Offshore construction and installation activities are beyond the scope of the petroleum activities considered in this EP. 1c) i) Offtake tanker vetting procedures are provided in Section 10.5.3. ii) The impacts and risks from produced formation water and naturally occurring radioactive materials, along with monitoring and management measures, are assessed in Section 9.9, Section 9.12.1 and Section 10.5.1. iii) The impacts and risks from artificial lighting and noise, along with monitoring and management measures, are assessed in Section 9.4 and Section 9.5. iv) Procedures for supply vessels and aircraft that are consistent with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 are provided in Section 9.5 and Section 9.7. v) Measures for reporting environmental incidents are provided in Section 10.6.2. This EP was originally submitted greater than two months prior to commencing Prelude FLNG operations.

Approval Conditions (EPBC 2008/4146)	Relevant EP Sections
d) Cetacean interaction procedures for supply vessels and aircraft that are consistent with Part 8 of the *Environment Protection and Biodiversity Conservation Regulations 2000*; e) Cetacean sightings reporting; and f) Measures for the reporting of environmental incidents. The plan (or plans) must be submitted at least two months prior to the commencement of these activities. Individual offshore activities, as defined within these conditions, may not commence until the plan (or plans) for that specific activity have been approved. The approved plan (or plans) must be implemented.	
4) The person taking the action must develop and submit to the Minister for approval, an Oil Spill Contingency Plan that demonstrates the response preparedness of the person taking the action for any hydrocarbon spills, including the capacity to respond to a spill and mitigate the environmental impacts. The Plan must include, but is not limited to: a) Oil spill trajectory modelling for potential spills from the action. This should include consideration of a well blow out or uncontrolled release. The modelling should be specific to the characteristics of the hydrocarbons contained in the Prelude gas field, the likely volumes released in a worst-case scenario spill, and the potential time over which the oil may be released in a worst-case scenario spill, including a scenario of eleven (11) weeks uncontained spill. b) A description of resources available for use in containing and minimising impacts in the event of a spill and arrangements for accessing these. c) A demonstrated capacity to respond to a spill at the site, including application of dispersants, if required and appropriate, and measures that can feasibly be applied within the first 12 hours of a spill occurring. d) Identification of sensitive areas that may be impacted by a potential spill, in particular Browse Island, specific response measures for these areas and prioritisation of these areas during a response. e) Training of staff in spill response measures and identifying roles and responsibilities of personnel during a spill response. f) Procedures for reporting oil spill incidents. The Oil Spill Contingency Plan must be submitted at least three months prior to the commencement of drilling activities. The person taking the action must not commence Prelude production drilling activities until the Oil Spill Contingency Plan is approved. The approved Oil Spill Contingency Plan must be implemented.	Shell has undertaken a detailed hydrocarbon spill risk assessment, developed an Oil Pollution Emergency Plan (OPEP) (HSE_PRE_013075) and an associated Operational and Scientific Monitoring Plan (OSMP) (which includes the APPEA OSMP Framework and supporting Operational and Scientific Monitoring Bridging and Implementation Plan) which combined with this EP, meet the requirements of condition 4 as per the following: a) Key outputs from oil spill trajectory modelling for potential spills are provided in Section 9.14. b) Spill resource availability and access requirements are addressed in the OPEP. c) Demonstrated capacity (including dispersant application) to respond to a spill is provided for in the OPEP. d) Environmental sensitivities (including Browse Island) located within the Zone of Potential Impact (ZPI) are described in Section 9.14. Specific response measures for Browse Island and the Spill Impact Mitigation Assessment (SIMA) process are provided in the OPEP. e) Training requirements for personnel undertaking oil spill response are provided in Section 10.4.2. Roles and responsibilities for spill response are contained within the OPEP. f) Requirements for reporting oil spill incidents are provided in Section 10.12.4 and the OPEP.

Approval Conditions (EPBC 2008/4146)	Relevant EP Sections
5) The person taking the action must develop and submit to the Minister for approval, and Operational and Scientific Monitoring Program that will be implemented in the event of an oil spill to determine the potential extent and ecosystem consequences of such a spill, including, but not limited to: a) Triggers for the initiation and termination of the Operational and Scientific Monitoring Program, including, but not limited to, spill volume, composition, extent, duration and detection of impacts; b) A description of the studies that will be undertaken to determine the operational response, potential extent of impacts, ecosystem consequences and potential environmental reparations required as a result of the oil spill. c) Inclusion of sufficient baseline information on the biota and the environment that may be impacted by a potential hydrocarbon spill, to enable an assessment of the impacts of such a spill. d) A strategy to implement the scientific monitoring plan, including timelines for delivery of results and mechanisms for the timely peer review of studies, and e) Provision for periodic review of the program. The Operational and Scientific Monitoring Program must be submitted at least three months prior to the commencement of drilling activities. The person taking the action must not commence Prelude production drilling activities until the Operational and Scientific Monitoring Program is approved. The approved Operational and Scientific Monitoring Program must be implemented.	As stated above, Shell has adopted an OSMP that may be implemented in the event of a hydrocarbon spill. The OSMP scales in response to the nature and scale of the spill and the environmental receptors at risk. The OSMP has discrete initiation and termination criteria for each of the components of the OSMP. The OSMP includes consideration of baseline data and provides for sampling of receptors identified at being at risk prior to being contacted by hydrocarbons in the event of a spill. The arrangements by which Shell maintains preparedness to implement operational and scientific monitoring are detailed in the OSMP, the OPEP and Section 10.9.
7) The person taking the action must submit a Decommissioning Plan to the Minister for approval one year prior to the decommissioning of the Prelude Floating Natural Gas Facility or any subsea wells, flowlines or associated infrastructure. The Decommissioning Plan must consider the complete removal of all structures and components above the sea floor. The approved Decommissioning Plan must be implemented.	No decommissioning activities are planned as part of the petroleum activities considered in this EP.
11) The person taking the action may choose to revise a management plan approved by the Minister under conditions 1, 4, 5 and 7 without submitting it for approval under Section 143A of the EPBC Act, if the taking of the action in accordance with the revised plan would not be likely to have a new or increased impact. If the person taking the action makes this choice they must: i) Notify the Department in writing that the approved plan has been revised and provide the Department with an electronic copy of the revised plan; ii) Implement the revised plan from the date that the plan is submitted to the Department; and	Shell may revise the EP, OPEP and OSMP without providing notification to the Minister or NOPSEMA if no significant new environmental risks/impacts or increases to identified environmental risks/impacts considered in these plans are identified. Triggers for submission of an EP revision to NOPSEMA are provided in Section 10.1.

Approval Conditions (EPBC 2008/4146)	Relevant EP Sections
iii) For the life of this approval, maintain a record of the reasons the person taking the action considers that taking the action in accordance with the revised plan would not be likely to have a new or increased impact.	
11a) The person taking the action may revoke their choice under condition 11 at any time by notice to the Department. If the person taking the action revokes the choice to implement a revised plan, without approval under Section 143A of the Act, the plan approved by the Minister must be implemented.	Shell does not intend to revoke their choice in relation to the submission of plans detailed in condition 11. If Shell do elect to revoke their choice, they will implement the plan approved by the Minister.
11b) If the Minister gives a notice to the person taking the action that the Minister is satisfied that the taking of the action in accordance with the revised plan would be likely to have a new or increased impact, then: i) Condition 11 does not apply, or ceases to apply, in relation to the revised plan; and ii) The person taking the action must implement the plan approved by the Minister. To avoid any doubt, this condition does not affect any operation of conditions 11 and 11A in the period before the day the notice is given. At the time of giving the notice the Minister may also notify that for a specified period of time that condition 11 does not apply for one or more specified plans required under the approval.	Shell accepts that any new or increased impact in a revision to a management plan specified in condition 11 will result in condition 11 not being applicable and Shell will implement the plan accepted by the Minister.
11c) Conditions 11, 11A and 11B are not intended to limit the operation of Section 143A of the Act which allows the person taking the action to submit a revised management plan to the Minister for approval.	Not directly applicable to this EP.
14) A plan or program required by condition 1, 4 or 5 has been approved by the Minister and the measures (as specified in the relevant conditions) are included in an environment plan (or Environment Plans) that: a) Was submitted to NOPSEMA after 27 February 2014; or b) Either: i) Is in force under the OPGGS Environment Regulations; or ii) Has ended in accordance with regulation 25A of the OPGGS Environment Regulations.	Noted – Shell intends to meet the requirements of the consolidated conditions detailed in EPBC 2008/4146 by submitting the EP, OPEP and OSMP to NOPSEMA.
14A) Where a plan or program required by condition 1, 4 or 5 has been approved by the Minister and the measures (as specified in the relevant condition) are included in an environment plan (or Environment Plans) that: a) Was submitted to NOPSEMA after 27 February 2014; or	Shell has submitted the plans required by conditions 1, 4 and 5 to NOPSEMA as part of an EP submission for the activity.

Approval Conditions (EPBC 2008/4146)	Relevant EP Sections
b) Either: i) Is in force under the OPGGS Environment Regulations; or ii) Has ended in accordance with regulation 25A of the OPGGS Environment Regulations. the plan or program approved by the Minister no longer needs to be implemented provided the environment plan remains in force.	
14B) Where an environment plan, which includes measures specified in the conditions referred to in conditions 14 and 14A above, is in force under the OPGGS Environment Regulations that relates to the taking of the action, the person taking the action must comply with those measures as specified in that environment plan.	Shell intends to comply with the conditions in the EP submissions made to NOPSEMA.

3.2.2.2 EPBC Act Management Publications

3.2.2.2.1 Australian Marine Park Management Plans

The EPBC Act provides for the declaration of Australian Marine Parks (AMPs) based on the International Union for the Conservation of Nature (IUCN) principles and guidelines for categorising protected areas. Australia has established a network of AMPs throughout Commonwealth waters, which are managed under a series of region-based management plans. These plans detail the management objectives of the AMPs, the environmental values within each of the AMPs and the activities that are permissible within the zones of the AMPs. AMPs are part of the Commonwealth Marine Area (Section 7.3), which is an MNES.

The planned petroleum activities considered within this EP will not credibly impact upon any AMPs, however an emergency event may potentially impact upon several AMPs. These AMPs are described in Section 7.3 and managed under the Australian Marine Parks – North–west Marine Parks Network Management Plan 2018 (DNP 2018a).

The requirements of relevant AMP management plans were considered as part of Shell's setting acceptable levels of environmental impacts and risks.

3.2.2.2.2 Recovery Plans and Conservation Advice

Species and communities listed as threatened under the EPBC Act are MNES and receive protection under Commonwealth law. The Threatened Species Scientific Committee may publish conservation advice for a threatened species, which provides information on threats and conservation management. The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) has developed recovery plans relating to threatened species. Recovery plans provide a framework to prevent further decline, and facilitate the recovery, of threatened species. Recovery plans may contain actions that warrant consideration during the assessment of environmental impacts and risks. Recovery plans may also identify habitat critical for the survival of a species; such habitat is protected under the EPBC Act.

Shell has identified a number of threatened species that may credibly be impacted, or are at risk of being impacted, by the petroleum activities considered in this EP. Details on these species, along with relevant information from recovery plans and conservation advice, are provided in Section 7.7.10.

3.2.2.2.3 Other

Other EPBC Act publications, such as guidance and policy statements, are described in Section 3.3.

3.3 Standards and Guidelines

3.3.1 Industry, Australian and International Standards and Guidelines

In Australia, the petroleum exploration and production industry operate within an industry code of environmental practice developed by the Australian Petroleum Production and Exploration Association (APPEA), now Australian Energy Producers (AEP). The code provides guidelines for petroleum activities and has evolved from the collective knowledge and experience of the oil and gas industry both nationally and internationally. The code provides the Australian petroleum industry with guidance on management measures to protect the environment during exploration, production and decommissioning phases. Shell is a signatory to the APPEA guidelines and will align with their intent in the implementation of this EP.

The following Australian guidelines are also applicable to the activity (as defined in Section 9):

- NOPSEMA Guidance Note GN1344 – Environment plan content requirements – July 2025 (NOPSEMA 2025)
- NOPSEMA Guideline GL2086 – Consultation in the course of preparing an environment plan – May 2024 (NOPSEMA 2024a)
- NOPSEMA Guideline GN1847 – Responding to public comment on environment plans – January 2024 (NOPSEMA 2024b)
- NOPSEMA Guideline GL1887 – Consultation with Commonwealth agencies with responsibilities in the marine area – November 2024 (NOPSEMA 2024c)

- NOPSEMA Information Paper IP1765 – Acoustic impact evaluation and management – September 2025 (NOPSEMA 2025a)
- NOPSEMA Guidance Note GN1343 – Petroleum activity – April 2025 (NOPSEMA 2025b)
- NOPSEMA Guidance Note GN1785 – Petroleum activities and Australia Marine Parks – August 2025 (NOPSEMA 2025c)
- NOPSEMA Guidance Note GN1488 – Oil pollution risk management – July 2025 (NOPSEMA 2025d)
- NOPSEMA Information Paper IP1349 – Operational and scientific monitoring programs – January 2024 (NOPSEMA 2024d)
- NOPSEMA Information Paper IP2002 – Planning for proactive decommissioning – January 2025 (NOPSEMA 2025e)
- NOPSEMA Policy PL1903 – Section 572: Maintenance and removal of property (NOPSEMA 2020)
- Australian Ballast Water Management Requirements (DAWE 2020)
- National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2009)
- Australian biofouling management requirements version 2 (DAFF 2023)
- Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities (AMSA 2015)
- Matters of National Environmental Significance – Significant Impact Guidelines 1.1 (DoE 2013)
- EPBC Act Policy Statement 'Indirect consequences' of an action (DSEWPaC 2013a)
- National Plan for Maritime Environmental Emergencies – 2020 edition (AMSA 2020)
- Marine Oil Pollution: Response and Consultation Arrangements (Department of Transport 2020)
- EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (CoA 2017c)

The following international guidelines are also applicable to the project:

- Environmental Management in Oil and Gas Exploration and Production (United Nations Environment Program and Oil Industry International Exploration and Production Forum 1997).

3.4 International Agreements and Conventions

Australia is a signatory to several international agreements and conventions that are relevant to the environmental management of the petroleum activities considered in this EP. These agreements and conventions are typically implemented by Commonwealth legislation (see Section 3.2). Table 3-3 lists the relevant international agreements and conventions, along with a justification of their relevance to the petroleum activities considered in this EP.

Table 3-3: Summary of Relevant Legislation

Legislation	Summary	Relevance to this EP
Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth)	Protects areas and objects that are of particular significance to Aboriginal and/or Torres Strait Islander People	There are no requirements arising under this Act that apply to the environmental management of the activity. The EP considers heritage features and values (Section 7.10).
Aboriginal Heritage Act 1972 (WA)	This Act provides for the recognition, protection, conservation, and preservation of Aboriginal cultural heritage in Western Australia (WA).	There are no requirements arising under this Act that apply to the environmental management of the activity. The EP considers heritage features and values (Section 7.10).
Aboriginal Land Rights (Northern Territory) Act 1976 (Cth)	This Act allows for the granting of Aboriginal freehold title to Traditional Owners.	Spatial mapping of Aboriginal freehold land across the NT, and the identification of the associated Aboriginal Trusts was undertaken as part of the search for potentially relevant persons. This included a search for any Aboriginal Trusts associated with Aboriginal freehold land that intersected with or was adjacent to the Planning Area (Section 7.9.3).
Australian Heritage Council Act 2003 (Cth)	This Act identifies areas of heritage value, including those listed on the National Heritage List and the Commonwealth Heritage List (of which are MNES under the EPBC Act) and establishes the Australian Heritage Council.	There are no requirements arising under this Act that apply to the environmental management of the activity. The EP considers protected areas (Section 7.3.1).
Australian Maritime Safety Authority Act 1990 (Cth)	Establishes the Australian Maritime Safety Authority (AMSA) and provides for its functions, including to combat pollution in the marine environment. AMSA is also responsible for administering Marine Orders in Commonwealth waters. The Act also aims to promote maritime safety, protect the marine environment from pollution and environmental damage from ships, provide for a national search and rescue service and promote the efficient provision of service by AMSA. AMSA is the control agency for vessel-based non-petroleum activity spills in Commonwealth waters.	AMSA has been consulted as a Relevant Person – see Section 5 in preparing the EP and will be notified throughout activities in accordance with Section 10.12. AMSA's relevant functions are vessel emergencies, including oil spills in Commonwealth waters (Section 9.14).

Legislation	Summary	Relevance to this EP
Biodiversity Conservation Act 2016 (WA) *Biodiversity Conservation Regulations 2018* (WA)	Requires WA conservation management agencies to take a lead role in oiled wildlife response (OWR) in WA. The WA Department of Biodiversity, Conservation and Attractions (DBCA) has the responsibility and statutory authority to conserve, protect and manage wildlife, including threatened species	Any OWR will comply with this Act and the WA Oiled Wildlife Response Plan.
Biosecurity Act 2015 (Cth) *Biosecurity Regulations 2016* (Cth) Australian Ballast Water Management Requirements, Version 8 Australian Biofouling Management Requirements (Version 2, 2023)	Provides for managing the risk of pests and diseases entering Australian territory that may cause harm to human, animal or plant health or the environment. The Act includes requirements for pre-arrival reporting, ballast water management plans and certificates.	This Act applies to foreign vessels operating in Australian waters which must comply with the requirements of this Act and the Regulations. The activity will comply with biosecurity requirements, specifically in relation to vessel biofouling and ballast water requirements (Section 9.8).
Climate Change Act 2022 (Cth)	This Act commenced in September 2022 and sets out Australia's net-zero commitments and codifies Australia's net 2030 and 2050 GHG emissions reductions targets under the Paris Agreement.	The oil and gas sector is not subject to direct obligations under this Act; however, this Act legislates Australia's emissions net-zero targets by 2050. Refer to the Shell climate target (Shell 2024) and Section 10.7.
Emergency Management Act 2005 (WA)	Provides for processes for hazard management. Requires the WA Department of Transport (WA DoT) (Hazard Management Agency) to be the control agency for spills within or entering WA state waters. The WA State Emergency Management Plan for Marine Oil Pollution was made in accordance with the Act.	Emergencies, including oil spills that enter WA waters will comply with this Act (Sections 9.12.1 and 9.14).
Environmental Protection Act 1986 (WA) Environmental Protection (Unauthorised Discharges) Regulations 2004 (WA) (Unauthorised Discharges Regulations) Environment Protection (Controlled Waste) Regulations 2004 (WA) (Controlled Waste Regulations)	This Act provides for the prevention, control and abatement of pollution and environmental harm and for the conservation, preservation, protection, enhancement and management of the environment. The Act also establishes offences for certain environmental harms. The Unauthorised Discharges Regulations regulate certain discharges into the environment that do not cause pollution or harm for the purposes of the EP Act, but which result from business or commercial activity. The Controlled Waste Regulations	Emergencies, including oil spills that enter WA waters will comply with this Act (Sections 9.12.1 and 9.14).

Legislation	Summary	Relevance to this EP
	regulate the transportation of controlled wastes, including the storage, handling, labelling, transport and tracking of such wastes. The Unauthorised Discharges Regulations will apply to the activity to the extent that there are unplanned hydrocarbon and chemical releases during spill response actions in WA waters. The Controlled Waste Regulations apply to the transportation of controlled wastes during spill response actions in WA waters.	
Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth)	While the OPGGS(E) Regulations under the OPGGS Act (see below) regulate day to day petroleum activities and apply to any activity that may have an impact on the environment, the EPBC Act regulates the assessment and approval of proposed actions that are likely to have a significant impact on a matter of National Environmental Significance (MNES). See Section 3.2.2 for a detailed description of the requirements.	The Prelude Project is approved under the EPBC Act. This Act is relevant to the environmental management of the Activity. See Sections 7 and 8.1.3 for a description and treatment of MNES respectively.
Fisheries Management Act 1991 (Cth)	This Act sets out specific functions which apply to the Australian Fisheries Management Authority (AFMA), including in relation to the regulation of fishing and the development of management plans for fisheries. Commonwealth fisheries are managed by the AFMA under the Act.	This Act is not directly relevant to the environmental management of the activity. However, AFMA has management responsibilities under this Act in respect of the Commonwealth managed fisheries which overlap the Activity Area (of which there are three) and the Planning Area as provided for in Table 7-18. Accordingly, this Act has been identified for the purpose of contextualising the consultation undertaken with the AFMA in the course of preparing this EP, as set out in Section 5 and Appendix B.
Fish Resources Management Act 1994 (WA)	This Act applies provides for the management of fish resources and fisheries in WA, the conservation of fish and the protection of their environment. Under this Act, Joint Authorities are established with specific responsibilities for the management of fisheries in WA waters. Additionally, WA–managed fisheries are managed by DPIRD in accordance with the regulatory requirements applicable under this Act. This Act is set to be repealed by the *Aquatic Resources Management Act 2016* (WA).	The Act is not directly relevant to the environmental management of the activity. However, there are 10 WA managed fisheries within the Activity Area, with the Planning Area overlapping an additional fishery (as provided for in Table 7-18). Accordingly, this Act has been identified for the purpose of contextualising the consultation undertaken with the WA Department of Primary Industries and Regional Development in the course of preparing this EP, as set out in Section 5 and Appendix B.

Legislation	Summary	Relevance to this EP
Hazardous Waste (Regulation of Exports and Imports) Act 1989 (Cth)	Regulates the export, import and transport of hazardous waste to ensure that hazardous waste is managed appropriately so that human health and the environment are protected from the harmful effects of the waste. The Act gives effect to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1972 (commonly referred to as the Basel Convention).	The activity does not involve transboundary movement of hazardous wastes.
Marine Safety (Domestic Commercial Vessel) National Law Act 2012 (Cth) Marine Safety (Domestic Commercial Vessel) National Law Regulation 2013 (Cth) Marine Orders	This Act is a single regulatory framework for the certification, construction, equipment, design and operation of domestic commercial vessels inside Australia's exclusive economic zone (EEZ). The Act names AMSA as the National Marine Safety Regulator and confers functions on AMSA in relation to marine safety, including that AMSA may make and maintain Marine Orders. The Regulations under the Act set out the definition of a vessel and details and requirements of the accredited marine surveyor scheme.	Shell will ensure the vessels undertaking activities under this EP comply with applicable maritime law and regulations.
National Environment Protection (National Pollutant Inventory) Measure 1998 (established under the *National Environment Protection Council Act 1994*) (Cth)	Provides the framework for developing and establishing the National Pollutant Inventory (NPI), which provides publicly available information on the types and amounts of listed toxic substances being emitted into the Australian environment. These substances were identified as important due to their possible effect on human health and the environment.	The activity will comply with the NPI National Environment Protection Measure (NEPM) by reporting relevant NPI substances (Section 9.11).
National Environment Protection Council Act 1994 (Cth)	Establishes the National Environment Protection Council, whose primary functions are to: • define NEPMs to ensure Australians have equivalent protection from air, water, soil, and noise pollution. • assess and report the implementation and effectiveness of NEPMs.	The activity will comply with the requirements of the relevant NEPMs (Section 9.11).
National Greenhouse and Energy Reporting Act 2007 (Cth)	Provides a single, national framework for reporting and distributing information related to GHG emissions, GHG projects, energy production and energy consumption. Reporting obligations are	Shell reports as a corporate group under the Act; this includes reports related to emissions from activities under its operational control (Section 9.12).

Legislation	Summary	Relevance to this EP
National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Cth)	imposed upon corporations that meet emissions and/or energy thresholds. In addition to the Act's reporting requirements, the Safeguard Mechanism is administered by the Clean Energy Regulator (CER). The safeguard mechanism provides a framework for Australia's largest emitters to measure, report and manage their emissions. The Safeguard Mechanism requires, among other things, that large facilities whose net emissions exceed the safeguard threshold of carbon dioxide equivalent (CO_2-e) per annum keep their net emissions at or below emissions baselines.	If operational control is determined to sit with Shell's contractors, it is each contractor's responsibility to adhere to the Act. The Safeguard Mechanism will be directly applicable to GHG emissions at the Prelude FLNG facility (which is a Designated Large Facility under the NGER framework), including emissions generated at Prelude while processing Crux gas. Specifically, the Responsible Emitter of the Prelude FLNG facility will be required to surrender prescribed carbon units equal to 100% of reservoir CO_2 separated from Crux feed gas at the facility, being an estimated 9.78 $MtCO_2^{-e}$ over the life of the reservoir (Sections 3.5.6 and 9.12.11). The Crux reservoir CO_2 is the responsibility of the facility from which it is emitted, in this case, the Prelude FLNG for the Crux reservoir (Sections 3.5.6 and 9.12.11).
Native Title Act 1993 (Cth)	The Act recognises the rights and interests of Aboriginal and Torres Strait Islander people in land and waters according to their traditional laws and customs and creates processes through which native title can be recognised and protected. Under s 280(2) of the OPGGS Act, petroleum activities must be carried out in a manner that does not interfere with the enjoyment of native title rights and interests under the Native Title Act to a greater extent than necessary.	The Planning Area does not overlap any native title determinations. The activity will not interfere with the enjoyment of native title rights and interests under the *Native Title Act 1993* (Cth) to a greater extent than necessary (i.e. to acknowledge compliance with Section 280(2) of the OPGGS Act). Based on the summary column, this is the relevant obligation in relation to native title. See Section 7.9.3.2.2. Refer also to Section 5 in relation to consultation.
Navigation Act 2012 (Cth) Navigation Regulations 2023 (Cth) Marine Order 21 (Safety and emergency arrangements) 2016 (Cth) Marine Order 27 (Safety of navigation and radio equipment) 2023 (Cth) Marine Order 30 (Prevention of collisions) 2016 (Cth)	Relates to maritime safety and the prevention of pollution of the marine environment in Australian waters. It gives effect to several international conventions relating to maritime issues to which Australia is a signatory. Under the Act, AMSA has the power to make Marine Orders regarding any matters that provision must or may be made by the Regulations.	The activity, including vessels, will adhere to the Act and subsidiary legislation enabled by the Act, such as Marine Orders relating to the international conventions listed in Table 3-3.

Legislation	Summary	Relevance to this EP
Marine Order 71 (Masters and deck officers) 2024 (Cth)		
Northern Territory Aboriginal Sacred Sites Act 1989 (NT)	This Act establishes procedures for the protection and registration of sacred sites and the avoidance of sacred sites in the development and use of land. The Act also provides for entry onto sacred sites and specifies the conditions that apply to such entry and establishes the Aboriginal Areas Protection Authority (AAPA), which is responsible for, among other things, the enforcement of the Act.	A search of the NT AAPA Sacred Sites Register was undertaken in 2023 and refreshed in 2026 to identify potential sacred sites (registered and recorded) that overlap with the Planning Area (refer Section 7.10.1.2.4.3).
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth) Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (Cth) Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009 (Cth)	Petroleum exploration and development activities in Australia's offshore areas are subject to the environmental requirements specified in the OPGGS Act and associated Regulations. See Section 3.2.1 for a detailed description of the requirements.	Requirements under the OPGGS Act and associated Regulations are addressed throughout this EP and it demonstrates that the environmental impacts and risks resulting from the Activity are reduced to ALARP, are acceptable, and will be undertaken in line with the principles of ESD.
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 (Cth) Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995 (Cth)	Aims to protect the environment by reducing emissions of ozone depleting substances (ODSs) and synthetic greenhouse gases (SGGs). It controls the manufacture, import and export of ODSs and SGGs and products containing these gases.	The activity will adhere to restrictions on importing and using ODSs/SGGs by implementing appropriate measures that control procuring of products which contain these gases. The Act will only apply to Shell if it manufactures, imports or exports ozone depleting substances.
Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 (Cth) Marine Order 98 (Marine pollution prevention — anti-fouling systems) 2023 (Cth)	Aims to protect the marine environment from the effects of harmful antifouling systems. Under the Act, the negligent application of a harmful antifouling compound to a ship by a person or persons is an offence. The Act also requires that all Australian ships (that meet specific criteria) must hold 'antifouling certificates.	Vessels associated with offshore petroleum activities are required to adhere to this Act. See Section 9.7 in relation to the environmental impact assessment for Invasive Marine Species.
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth)	Regulates discharges from ships to protect the sea from pollution. These discharges include oil or oily mixtures, noxious liquid	Vessels are subject to this Act and will adhere to the requirements for discharges and waste management outlined in the relevant

Legislation	Summary	Relevance to this EP
Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994 (Cth) Marine Order 91 (Marine pollution prevention — oil) 2025 Marine Order 93 (Marine pollution prevention — noxious liquid substances) 2014 Marine Order 94 (Marine pollution prevention — packaged harmful substances) 2014 Marine Order 95 (Marine pollution prevention — garbage) 2018 Marine Order 96 (Marine pollution prevention — sewage) 2018 Marine Order 97 (Marine pollution prevention — air pollution) 2022	substances, packaged harmful substances, sewage, and garbage. The Act imposes a duty to report certain incidents involving prohibited discharges and to maintain record books and management plans. The Act and its subsidiary Marine Orders enact the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL).	MARPOL and Marine Orders (as appropriate to vessel class). See Section 9.7.
Protection of the Sea (Powers of Intervention) Act 1981 (Cth) Protection of the Sea (Powers of Intervention) Regulations 1983 (Cth)	Under this Act, the Commonwealth is empowered to take measures to protect the sea from pollution by oil and other noxious substances which may be discharged from ships. The AMSA is established as the Authority under this Act and has broad powers which include the power to take such measures it considers necessary to prevent pollution of the sea from oil and other substances.	Shell will be required to comply with the Act in the event of a spill of oil or noxious subjects from Activity vessels. Further, AMSA's powers under the Act are relevant to any event of an MDO spill arising from activities under this EP. See Section 9.14.
Underwater Cultural Heritage Act 2018 (Cth) (UCH Act)	Aims to protect Australia's underwater cultural heritage. The Act protects Australia's shipwrecks and broadens protection to sunken aircraft and other types of Underwater Cultural Heritage (UCH).	There are no declared protected UCH sites within the Activity Area. Multiple known shipwrecks, sunken aircraft, and historic (more than 75 years old) aircraft and shipwrecks and other sites occur within the Planning Area. Planned petroleum activities will not interfere with any known UCH site (see Sections 7.9.1 and 9.6).

Table 3-4: Summary of Relevant International Agreements and Conventions

Agreement/Convention	Summary	Relevance to this EP
Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment 1974 (JAMBA)	This agreement aims to conserve migratory bird species that travel between Japan and Australia. This includes many species of shorebirds that use the East Asian–Australasian Flyway (EAAF). It is implemented in Commonwealth law by the EPBC Act, which makes provision for species listed under JAMBA to be listed as migratory under the EPBC Act. Species listed as migratory under the EPBC Act are MNES.	Several birds listed as migratory under the EPBC Act were identified as potentially being impacted by the petroleum activities considered in this EP. See Section 7.3.1.4.
Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment 1986 (CAMBA)	This agreement aims to conserve migratory bird species that travel between China and Australia. This includes many species of shorebirds that use the EAAF. It is implemented in Commonwealth law by the EPBC Act, which makes provision for species listed under CAMBA to be listed as migratory under the EPBC Act. Species listed as migratory under the EPBC Act are MNES.	Several bird species that use the EAAF were identified as potentially being impacted by the petroleum activities considered in this EP. See Section 7.3.1.4.
Agreement between the Government of Australia and the Government of the Republic for Korea for the Protection of Migratory Birds and their Environment 2007 (ROKAMBA)	This agreement aims to conserve migratory bird species that travel between the Republic of Korea and Australia. This includes many species of shorebirds that use the EAAF. It is implemented in Commonwealth law by the EPBC Act, which makes provision for species listed under ROKAMBA to be listed as migratory under the EPBC Act. Species listed as migratory under the EPBC Act are MNES.	Several birds listed as migratory under the EPBC Act were identified as potentially being impacted by the petroleum activities considered in this EP. See Section 7.3.1.4.
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal 1989 (Basel Convention)	This convention deals with the transboundary movement of hazardous wastes, particularly by sea. The *Hazardous Waste (Regulation of Exports and Imports) Act 1989* (Cth) gives effect to the Basel Convention in Australian law. The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes.	The activity does not involve transboundary movement of hazardous wastes.
Convention on the Conservation of Migratory Species of Wild Animals 1979 (the Bonn Convention)	This convention aims to conserve migratory fauna species throughout their ranges, particularly where their range crosses international jurisdictional boundaries. It is implemented in Commonwealth law by the EPBC Act, which makes provision for	Several species listed as migratory under the EPBC Act were identified as potentially being impacted by the petroleum activities considered in this EP. See Section 7.3.1.

Agreement/Convention	Summary	Relevance to this EP
	species listed under the Bonn Convention to be listed as migratory under the EPBC Act. Species listed as migratory under the EPBC Act are MNES.	
International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001	This convention prohibits the use of harmful organotins in antifouling paints applied on ships. Additionally, this Convention establishes a mechanism to prevent the potential future use of other harmful substances in antifouling systems. The *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) and subsidiary Marine Order give effect to the Convention.	Vessels are required to comply with this Convention. See Section 9.7.
International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004	This Convention was adopted by the International Maritime Organization (IMO) and entered into force globally in 2017. It aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for managing and controlling ships' ballast water and sediments. Thus, ballast water management systems must be approved in accordance with this Convention. From 8 September 2017, all vessels that use ballast water are required to meet the Regulation D2 discharge standard of this Convention at their next renewal survey. Implementation of the convention in Australia occurs through the *Biosecurity Act 2015* (Cth) and the Australian Ballast Water Management Requirements (DAWE 2020).	Vessels must manage their ballast water and sediments to a certain standard, according to a ship-specific ballast water management plan. All ships will also have to carry a ballast water record book and an international ballast water management certificate. This Convention is relevant in preventing the introduction of invasive marine species (IMS). See Section 9.8.
International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL)	This convention is an agreement to minimise the pollution of the marine environment by ships caused by operational or accidental causes. The convention provides a standardised approach to the environmental management of international and domestic shipping. The convention is implemented in Commonwealth law by the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), the *Navigation Act 2012* (Cth) and a series of Marine Orders made under this legislation.	Vessels are required to comply with MARPOL. See Section 8.

Agreement/Convention	Summary	Relevance to this EP
International Convention for the Safety of Life at Sea 1974 (SOLAS) and its Protocol of 1988	This convention provides internationally agreed minimum standards for the construction, equipment and operation of vessels. It is implemented in Commonwealth law by the *Navigation Act 2012* (Cth) and a series of Marine Orders made under this Act.	Vessels are required to comply with SOLAS. See Section 9.3.
International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978 (STCW Convention)	This convention provides a standardised approach to the qualifications and competencies of masters, officers and watch personnel. It is implemented in Commonwealth law by the *Navigation Act 2012* (Cth) and a series of Marine Orders made under this Act, specifically Marine Order 71 (Masters and Deck Officers).	Vessels and crew are required to comply with STCW Convention. See, for example, Sections 9.3 and 9.4.
Convention on Wetlands of International Importance 1975 (Ramsar)	This convention aims to conserve and promote the sustainable human use of wetlands. Many wetlands provide important habitat for migratory bird species, and Ramsar wetlands are important for conserving many species of migratory shorebirds and waders. Ramsar wetlands are protected under the EPBC Act and are MNES.	The Ashmore Reef Ramsar wetland was identified as potentially being impacted if an unplanned release of large volumes of hydrocarbons was to occur (e.g. vessel collision). See Section 7.3.1.4.
International Regulations for Preventing Collisions at Sea 1972 (COLREGS)	These regulations provide internationally agreed rules on vessel navigation, which are intended to reduce the likelihood of vessel collisions. COLREGS are implemented in Commonwealth law by the *Navigation Act 2012* (Cth)and a series of Marine Orders made under this Act, specifically Marine Order 30 (Prevention of Collisions) 2016.	Vessels are required to comply with COLREGS. See Sections 9.3 and 9.14.
Memorandum of Understanding between the Government of Australia and the Government of the Republic of Indonesia Regarding the Operations of Indonesian Traditional Fishermen in Areas of the Australian	This memorandum of understanding (MOU) recognises the long history of traditional Indonesian fishermen exploiting biological resources within Timor Sea waters within Australia's EEZ. The MOU provides for an area (commonly referred to as the MOU Box) within which traditional Indonesian fishing is permitted within sections of the Australian EEZ. The area includes several offshore	The Activity Area[2] is situated within the MOU Box. See Section 7.9.2.

[2] Defined as the petroleum titles WA-44-L and WA-2-IL.

Agreement/Convention	Summary	Relevance to this EP
Exclusive Fishing Zone and Continental Shelf 1974	reefs, including Ashmore Reef, Cartier Island, Scott Reef and Seringapatam Reef.	
Minamata Convention on Mercury	This convention aims to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The convention came into force in Australia on 7 March 2022 and is implemented through various legislative instruments, including the OPGGS Act and the OPGGS(E) Regulations. The National Implementation Plan: Minamata Convention on Mercury (October 2024) (DCCEEW 2024p) informs how the obligations of the convention are being implemented in Australia, and states "*The Regulations [OPGGS(E)] require that environment plans describe legislative and other requirements that apply and demonstrate how they will be met. NOPSEMA requires offshore oil and gas projects to be compliant with the Minamata Convention and to apply best available techniques and best environmental practices to control mercury releases and manage mercury waste in an environmentally sound manner*." Compliance is achieved through the requirement in the OPGGS(E) Regulations that environmental impacts and risks of an activity be reduced to ALARP and an acceptable level.	The Prelude Project aligns with relevant environmental conventions, including those related to mercury management. The activity will comply with the convention. There is a possibility that mercury from the wells may partition into various parts of the process including gas condensate, produced water and fuel gas. The Prelude project will control mercury releases and manage mercury waste to ensure that environmental impacts and risks of the activity are reduced to ALARP and an acceptable level. Shell has considered the intent of the Guidance on Best Available Techniques and Best Environmental Practices - Minamata Convention on Mercury (United Nations Environment Program 2019) which applies to emission point source and facilities listed in Annex D of the Minamata Convention, updated by the more recent Guidance on Best Available Techniques and Best Environmental Practices to Control Releases of Mercury from Relevant Sources (UNEP/MC/2024/3, October 2024) ('Minamata Guidelines'). Prelude will apply best available techniques (BAT) and best environmental practices (BEP) to control mercury releases and manage mercury waste. BAT and BEP are equivalent to an ALARP assessment, therefore to term ALARP in the context of assessment on mercury removal and reduction will use that term moving forward. Additionally, the project must comply with national reporting requirements, ensuring transparency and accountability in its mercury management practices. Design aspects and considerations are outlined in Section 9.
Paris Agreement on Climate Change (2015)	The Paris Agreement is an instrument made under the United Nations Framework Convention on Climate Change, with the central aim of strengthening the global response to the threat of	See Section 9.12 which refers to the Shell Group's climate target (Shell 2024).

Agreement/Convention	Summary	Relevance to this EP
	climate change by keeping the global temperature rise this century well below 2° C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5° C in order to prevent dangerous human caused interference with the climate system. It deals with GHG emissions mitigation, adaptation, and finance. The agreement's language was negotiated by representatives of 196 state parties, including Australia, and adopted by consensus on 12 December 2015, before entering in to force on 4 November 2016. Australia has since ratified the Paris Agreement. The Paris Agreement requires each party to: • volunteer its own Nationally Determined Contributions (NDCs), to report against them annually, and improve them if it is determined that the collective commitment to NDCs is considered ineffective or insufficient to keep global temperature increases to less than 2° C below pre-industrial levels. This allows for variation in emissions reduction performance according to the development status of the country. • determine, plan, and regularly report on the contribution that it undertakes to mitigate global warming. No mechanism forces a country to set a specific emissions target by a specific date, but each target should go beyond previously set targets. Under the Paris Agreement, Australia has set an NDC of a 43% reduction in GHG emissions by 2030 (based on 2005 levels). The Intergovernmental Panel on Climate Change (IPCC) released a report in October 2018 on the 1.5° C target, which concluded that global emissions need to reach net zero around mid-century to give a reasonable chance of limiting warming to 1.5° C.	
The East Asian–Australasian Flyway Partnership 2006	The EAAF Partnership was adopted in the list of the World Summit on Sustainable Development as a Type II initiative, which is informal and voluntary, and was launched on 6 November 2006. This partnership aims to protect migratory waterbirds, their habitat and the livelihoods of people who depend upon them.	Several migratory bird species that use the EAAF were identified as potentially being impacted by the petroleum activities considered in this EP. See Section 7.7.10.

3.5 Greenhouse Gas Legislative Framework

3.5.1 United Nations Framework Convention on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) came into force in 1994 and has been ratified by 198 Parties (197 States and one regional economic integration organisation). The aim of the UNFCCC is to prevent anthropogenic interference with the climate system.

The Kyoto Protocol is an instrument made under the UNFCCC. It operationalises the UNFCCC by committing industrialised countries (Annex I Parties) to limit and reduce GHG emissions. The Protocol is based on the principle of common but differentiated responsibilities. It acknowledges that individual countries have different capabilities in combating climate change, owing to economic development, and therefore puts the obligation to reduce current emissions on developed countries on the basis that they are historically responsible for the current levels of GHG in the atmosphere.

3.5.2 Paris Agreement

The Paris Agreement is also an instrument made under the UNFCCC, with the central aim of strengthening the global response to the threat of climate change by keeping the global temperature rise this century well below 2 Degrees Celsius (° C) above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5° C. It deals with GHG emissions mitigation, adaptation, and finance. The agreement's language was negotiated by representatives of 196 state parties, including Australia, and adopted by consensus on 12 December 2015, before entering in to force on 4 November 2016. Australia has since ratified the Paris Agreement. The Paris Agreement requires each party to:

- Volunteer its own Nationally Determined Contributions (NDCs), to report against them annually, and improve them if it is determined that the collective commitment to NDCs is considered ineffective or insufficient to keep global temperature increases to less than 2° C below pre-industrial levels. This allows for variation in emissions reduction performance according to the development status of the country.
- Determine, plan, and regularly report on the contribution that it undertakes to mitigate global warming. No mechanism forces a country to set a specific emissions target by a specific date, but each target should go beyond previously set targets.

3.5.3 Australia's Legislative Frameworks for Regulating and Reporting GHG Emissions

The Australian Government ratified the Paris Agreement and the Doha Amendment to the Kyoto Protocol on 10 November 2016. Australia's first commitment under this agreement was to reduce emissions by 26–28% of 2005 levels by 2030. With the change of government, this was superseded in June 2022 by an NDC that committed to a more ambitious 2030 target. The 2030 NDC:

- commits Australia to reduce GHG emissions by 43% below 2005 levels by 2030, which is a 15-percentage point increase on Australia's previous 2030 target
- reaffirms Australia's commitment to net zero emissions by 2050
- commits the government to providing an annual statement to parliament on progress towards these targets
- restores Australia's Climate Change Authority as a source of independent policy advice.
- In 2025, the Australian Government announced a 2035 emissions reduction target range. The 2035 NDC:
- reduce greenhouse gas emissions by 62–70% below 2005 levels by 2035.
- recommended by the Climate Change Authority under the Climate Change Act 2022 and accepted by the Australian Government.
- consistent with the goals of the Paris Agreement to limit global warming to well below 2°C and pursue efforts to limit it to 1.5°C.

3.5.4 Climate Change Act

The *Climate Change Act 2022* (Cth) sets out Australia's net-zero commitments and codifies Australia's net 2030 and 2050 GHG emissions reductions targets under the Paris Agreement.

3.5.5 National Greenhouse & Energy Reporting Scheme

Australia's commitments under the Paris Agreement are delivered through the primary legislation for emissions management, the NGER Act. The NGER Act provides a single, national framework for the reporting and distribution of information related to GHG emissions, GHG projects, energy production and energy consumption to meet the following objectives:

- inform government policy
- inform the Australian public
- help meet Australia's international reporting obligations
- assist Commonwealth, state and territory government programmes and activities
- avoid duplication of similar reporting requirements in the states and territories.

Under the NGER Act corporations which meet certain thresholds are required to report on Scope 1 and Scope 2 GHG emissions, energy production and energy consumption from the operation of facilities under the entity(s) operational control, enabling the capture of data on energy flows and transformations occurring throughout the economy. Shell reports as a corporate group under the Act; this includes reports related to emissions from activities under its operational control (Section 9.12).

3.5.6 Safeguard Mechanism

The Safeguard Mechanism under the NGER Act ensures Australia's largest emissions intensive industries measure, report and reduce their Scope 1 GHG emissions. It applies a decline rate to facilities' baselines so that they are reduced predictably and gradually over time on a trajectory consistent with achieving Australia's emission reduction targets of 43% below 2005 levels by 2030 and net zero by 2050.

- Facilities with GHG emissions exceeding the CO_2-e threshold per year must keep GHG emissions at or below set baselines
- If a facility exceeds its baseline, it must manage excess GHG emissions, such as by purchasing and surrendering Australian Carbon Credit Units (ACCUs)
- A requirement to offset 100% reservoir CO_2 from new reservoirs feeding existing LNG facilities
- Facilities must meet reporting and record-keeping requirements, including audits
- Penalties for non-compliance.

The Safeguard Mechanism will be directly applicable to GHG emissions at the Prelude FLNG facility (which is a Designated Large Facility under the NGER framework), including emissions generated at that facility while processing Crux gas. Specifically, the Responsible Emitter of the Prelude FLNG facility will be required to surrender prescribed carbon units equal to 100% of reservoir CO_2 separated from Crux feed gas at the facility, being an estimated 9.78 $MtCO_2$-e over the life of the reservoir. The Crux reservoir CO_2 is the responsibility of the facility from which it is emitted, in this case, the Prelude FLNG for the Crux reservoir (Section 9.12.11).

3.5.7 Climate-related financial disclosure

Within Australia, the Australian Accounting Standards Board (AASB) issued Australian-specific climate and sustainability reporting standards aligned to ISSB's standards.

AASB Standard 2, Climate-related disclosure, is a mandatory standard aligned with International Financial Reporting Standards (IFRS) and is applicable to the relevant entity which covers the Prelude FLNG.

Key pillars of the first Australian Sustainability disclosures are centred around:

- Governance & Strategy
- Risk Management

- Metrics & Targets.

4 Shell Environmental Management Framework

4.1 Shell Performance Framework

The Shell Performance Framework (SPF) (Figure 4-1) is the overarching framework adopted by Shell Group to deliver on its strategy. The SPF applies to all Shell Group companies and provides a consistent approach for how each company in the Shell Group operates.

The SPF provides a common language for how Shell Group talks about activities. It encourages a focus on business outcomes, a holistic approach to business challenges and the use of a plan-do-check-adjust loop (Improvement Cycle) to ensure continued learning and improvement. It also helps Shell Group companies think about how each part of the SPF (structure, processes, behaviours, skills, etc.) comes together to achieve the best performance (Figure 4-1) and how the Improvement Cycle aids in implementation of the framework using a plan-do-check-adjust cycle (Figure 4-2). Fundamental to the SPF is the Health, Safety, Security and Environment & Social Performance (HSSE & SP) Policy and Commitment (Section 4.2) and the Safety, Environment & Asset Management (SEAM) Standards (Section 4.3).

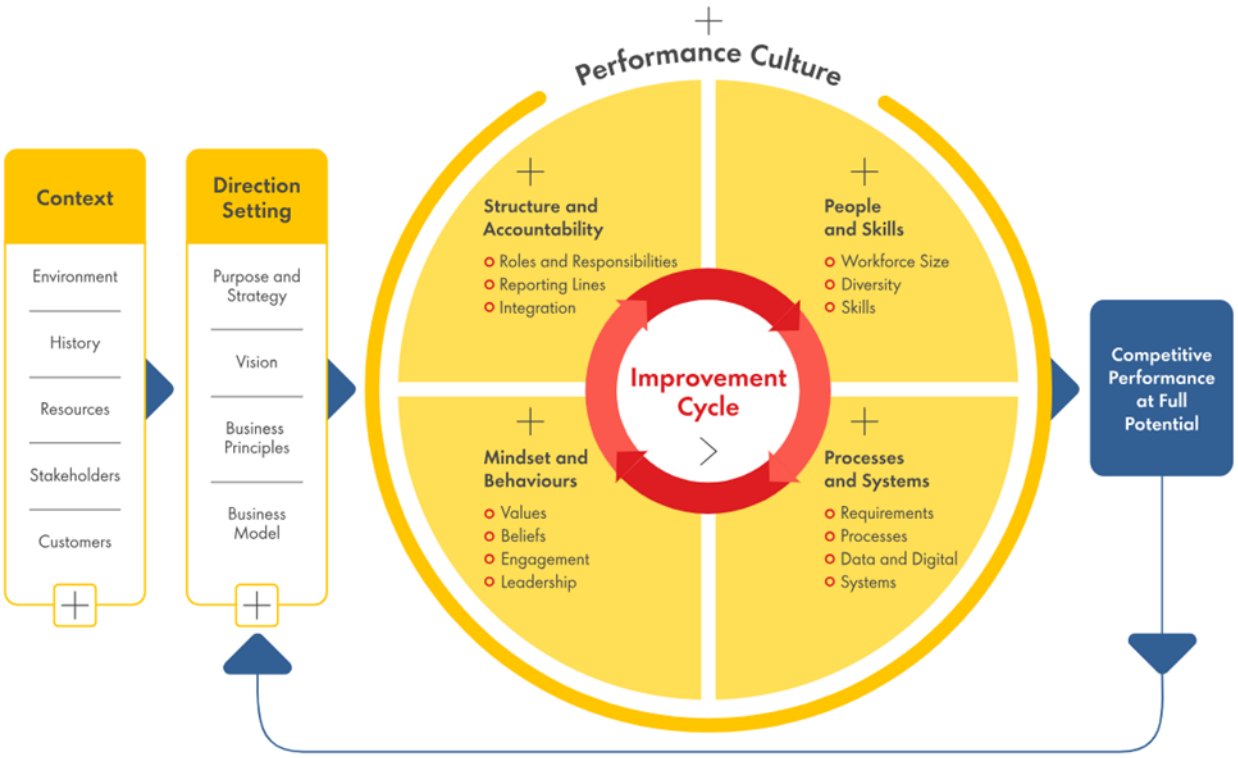


Figure 4-1: Shell Performance Framework

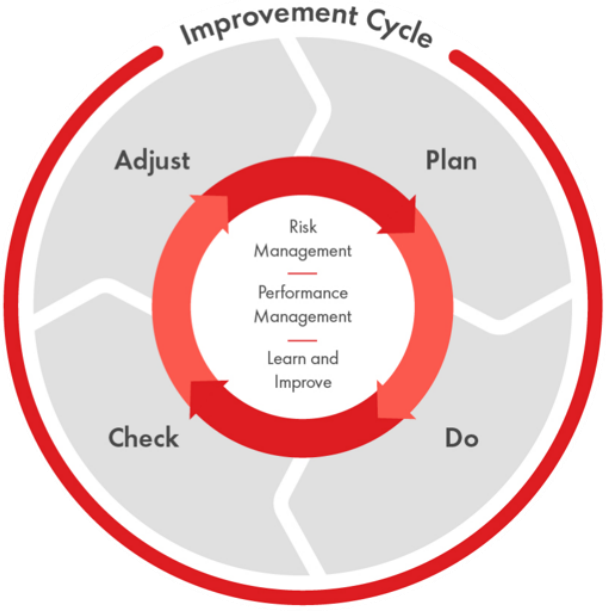
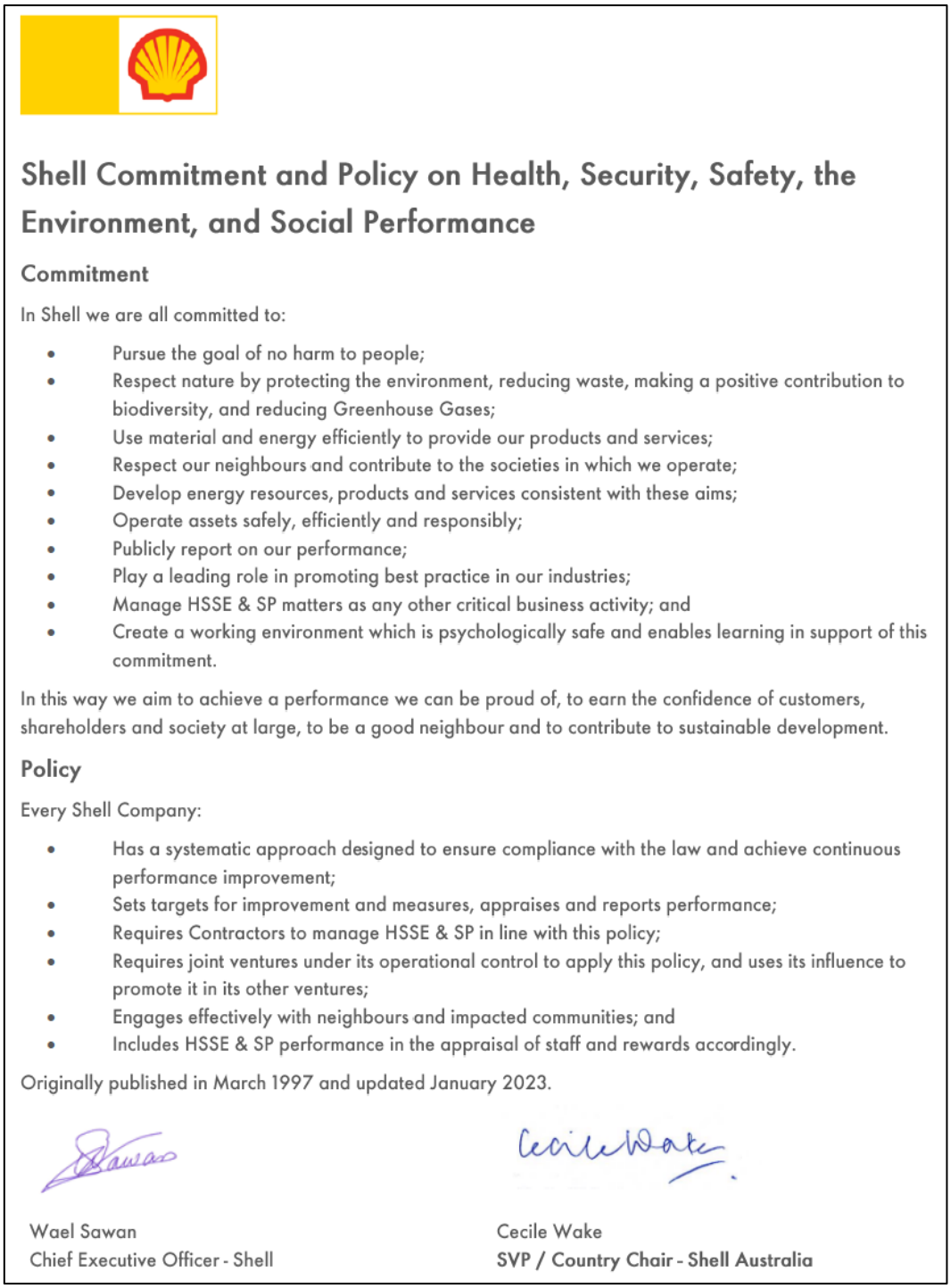


Figure 4-2: Shell Performance Framework Improvement Cycle

4.2 HSSE & SP Policy and Commitment

The Shell Commitment and Policy on HSSE & SP (Figure 4-3) is endorsed and adopted by the Chief Executive Officer of the Shell Group and Country Chair of Australia and displayed in Shell's offices and field asset workplaces. Some key features of the policy are to:

- Manage HSSE & SP requirements to ensure compliance with the law and to achieve continuous performance improvement
- Set targets for improvement and measurement, appraise and report performance
- Require contractors to manage HSSE & SP in line with Shell's expectations
- Effectively engage with neighbours and impacted communities.



Shell Commitment and Policy on Health, Security, Safety, the Environment, and Social Performance

Commitment

In Shell we are all committed to:

- Pursue the goal of no harm to people;
- Respect nature by protecting the environment, reducing waste, making a positive contribution to biodiversity, and reducing Greenhouse Gases;
- Use material and energy efficiently to provide our products and services;
- Respect our neighbours and contribute to the societies in which we operate;
- Develop energy resources, products and services consistent with these aims;
- Operate assets safely, efficiently and responsibly;
- Publicly report on our performance;
- Play a leading role in promoting best practice in our industries;
- Manage HSSE & SP matters as any other critical business activity; and
- Create a working environment which is psychologically safe and enables learning in support of this commitment.

In this way we aim to achieve a performance we can be proud of, to earn the confidence of customers, shareholders and society at large, to be a good neighbour and to contribute to sustainable development.

Policy

Every Shell Company:

- Has a systematic approach designed to ensure compliance with the law and achieve continuous performance improvement;
- Sets targets for improvement and measures, appraises and reports performance;
- Requires Contractors to manage HSSE & SP in line with this policy;
- Requires joint ventures under its operational control to apply this policy, and uses its influence to promote it in its other ventures;
- Engages effectively with neighbours and impacted communities; and
- Includes HSSE & SP performance in the appraisal of staff and rewards accordingly.

Originally published in March 1997 and updated January 2023.

Wael Sawan
Chief Executive Officer - Shell

Cecile Wake
SVP / Country Chair - Shell Australia

Figure 4-3: Shell's HSSE & SP Policy

4.3 Safety, Environment & Asset Management (SEAM) Standards

The Shell Group SEAM Standards are made up of one or more Requirements related to a specific risk or activity area with the intent to empower Shell Group businesses and assets to effectively address risk and drive performance. Shell Group companies are expected to adopt and apply relevant SEAM Standards which apply to their local context. The SEAM Standards include (see Figure 4-4):

- HSSE, SP and Asset Management Foundations Standard
- Carbon, Environment, Social Performance, Product Stewardship and Quality Standard

- Process Safety and Asset Management Standard
- Transport Safety Standard
- Workplace Health, Safety and Security Standard.

SEAM Requirements are mandatory rules that are designed to result in a consistent approach to major, Shell Group-wide risks or opportunities, external stakeholder expectations or external disclosures. They define the 'what' as opposed to the 'how'.

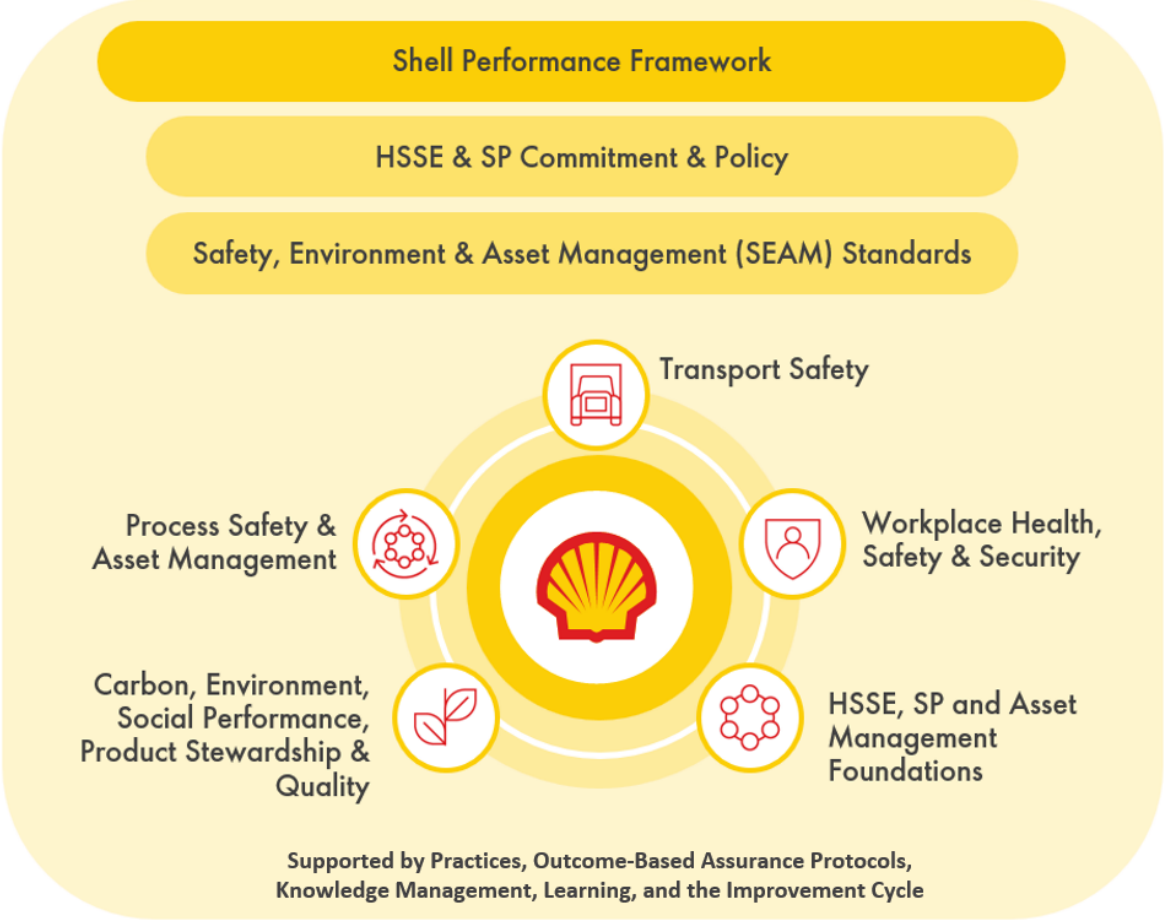


Figure 4-4: Shell Group Safety, Environment, and Asset Management Standards

The five standards include Shell Group requirements intended to manage the common/foundational elements of common risks and controls. It is the responsibility of the Country Chair, Business, or respective Functional Support Heads to operationalise the standards.

4.4 Shell Management System

The Shell Management System (Management System), including the 'HSSE & SP-MS', is a structured and documented system for effectively managing impacts and risks which demonstrates how Shell meets local legal requirements and implements the Requirements of the Shell Group SEAM Standards.

Environmental management for the Prelude Project occurs through the implementation of the MS, applied by combination of Shell Group SEAM Standard Requirements and project and asset systems/procedures as set out in this EP.

5 Relevant Person Consultation

5.1 Background

In accordance with section 25(1) of the OPGGS(E) Regulations, a titleholder must carry out consultation in the course of preparing an Environment Plan (EP).

In carrying out its duty to consult with relevant persons, the titleholder must:

I. give each relevant person sufficient information to allow them to make an informed assessment of the possible consequences of the activity on their functions, interests, or activities.

II. allow a relevant person a reasonable period for the consultation; and

III. tell the relevant person that they may request that particular information provided by the relevant person in the consultation not be published.

Effective consultation enables a titleholder to engage meaningfully with relevant persons, understand how each relevant person's functions, interests or activities may be affected by the proposed activity and adopt appropriate measures in response to any concerns raised.

Proactive engagement has been ongoing for Prelude since the discovery of the Prelude gas field in early 2007 and has continued since the Final Investment Decision (FID) in May 2011.

A range of relevant persons have been consulted throughout this time, including the Commonwealth and State Governments, commercial fishing associations, industry bodies, non-government organisations and local community and Indigenous relevant persons in key locations across the Kimberley and the Northern Territory.

The project received environmental approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) on 12 November 2010 (EPBC 2008/4146). Extensive consultation was subsequently carried out to support the acceptance of the:

- Prelude Drilling and Completions Environment Plan (2012)
- Prelude Subsea Installation Environment Plan (2014)
- Prelude Installation and Operations Environment Plan (2016)
- Prelude Operations Environment Plan revision (2021).

Consultation for this EP revision commenced in December 2024.

Table 5-1 provides a timeline for the consultation activities undertaken during the preparation of this EP. This timeline is illustrative and does not encompass the full scope of Shell's consultation efforts, which are detailed in the sections that follow.

Table 5-1: Prelude FLNG EP Revision Consultation Timeline (2024 - 2025)

ID	Activity	Start date	End date	Nov-24					Dec-24					Jan-25				Feb-25				Mar-25					Apr-25				May-25				Jun-25					Jul-25				Aug-25				Sep-25					Oct-25				Nov-25				Dec-25				
				28	4	11	18	25	2	9	16	23	30	6	13	20	27	3	10	17	24	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29
1	**Advertising / Public notices**																																																																
1.1	Print advertising campaign - calling out for self-identification of RPs	3-Feb-25	30-Apr-25																																																												
1.2	Radio advertising campaign - calling out for self-identification of RPs	3-Feb-25	30-Apr-25																																																											
1.3	Social media campaign - calling out for self-identification of RPs	3-Feb-25	30-Apr-25																																																											
1.4	Drop-in session promotion via print and digital																																																												
1.41	Derby	1-Apr-25	7-Apr-25																																																											
1.42	Broome	1-Apr-25	7-Apr-25																																																											
1.43	Kununurra	14-Mar-25	18-Mar-25																																																										
1.44	Wyndham	14-Mar-25	18-Mar-25																																																										
1.45	Darwin	22-Apr-25	29-Apr-25																																																										
2	**Website**																																																												
2.1	Website optimisations	1-Nov-24	30-Jan-25																																																										
2.5	Draft Prelude EP published	25-Sep-25																																																										
3	**Consultation material**																																																											
3.1	Consultation material mail out - sufficient information	1-Dec-25	24-Mar-25																																																									
3.2	Reminder emails	1-Mar-25	31-Mar-25																																																									
3.3	Final call emails sent to all RPs, including link to draft EP	24-Sep-25	29-Sep-25																																																								
3.4	Follow up phone calls, texts or other channels	1-Apr-25	7-Nov-25																																																								
4	**Drop-in sessions**																																																										
4.1	Derby	8-Apr-25	8-Apr-25																																																								
4.2	Broome	9-Apr-25	9-Apr-25																																																								
4.3	Djarindjin	28-Aug-25	28-Aug-25																																																								
4.4	Kununurra	19-Mar-25	19-Mar-25																																																								
4.5	Wyndham	18-Mar-25	18-Mar-25																																																								
4.6	Darwin	30-Apr-25	30-Apr-25																																																								
5	**Community information sessions**																																																										
5.1	Broome	8-Apr-25	8-Apr-25																																																								
5.2	Darwin	30-Apr-25	30-Apr-25																																																								
6	**Indigenous Consultation**																																																										
6.4	Targeted consultation sessions with NTRB's, RNTBC's, PBC's or Aboriginal Corporations	Ongoing																																																								

Consistent with Section 4 of the OPGGS(E) Regulations, Shell ensures that the environmental impacts and risks of an activity are reduced to ALARP and to an acceptable level.

The consultation process plays a critical role in achieving this objective. It enables a titleholder to identify, understand, and address the potential environmental impacts including those that may not otherwise be known. Through consultation, Shell gains valuable insights into the receiving environment, including (amongst other things) people and communities, the heritage value of places, and their social and cultural features which may be affected by the proposed activities.

Shell recognises the need to consult on both planned and unplanned activities. The Environment that May Be Affected (EMBA), referred to as the 'Planning Area' in this EP, has been determined based on the unlikely event of a hydrocarbon release from Shell's activities described in this EP. The Planning Area is further described and depicted in Section 6.1.

The Planning Area is used as a starting point for identifying persons and organisations that may have functions, interests or activities within the geographical area that may be affected by the proposed activity. Each person or organisation's functions, interests or activities are then further assessed to determine whether they meet the criteria of a relevant person under the OPGGS(E) Regulations.

The scope and duration of Shell's operations in Australia, along with a track record of consistent engagement with a diverse group of individuals and organisations, has allowed Shell to compile a comprehensive list of contacts for the consultation process. This list, built over years of experience, was not intended to be an exhaustive list of those to be consulted but rather served as a starting point to identify relevant persons for consultation on Shell's proposed activities. It incorporates valuable insights into the specific information that different individuals and organisations want to receive during consultation. Additionally, it includes the most appropriate means of communication and up-to-date contact information, which Shell regularly reviews and updates.

Shell's consultation approach is grounded in the principles of informed consultation, participation and co-design:

- Relevant persons are free to raise issues without pressure or undue influence (e.g. unreasonable timeframes due to approval timeline)
- Relevant persons are made aware of the consultation period and have the opportunity to be consulted.
- Sufficient and appropriate information is provided to enable persons and organisations to identify whether they are relevant or have a connection to the EP.
- Shell advises each relevant person that they may request information provided during consultation not be published, reflecting the requirements in section 25(4) of the OPGGS(E) Regulations.

Shell recognises the '*Consultation in the course of preparing an Environment Plan'* (doc no. N-04750-GL2086 A900179) guidance released by NOPSEMA in May 2024 and the judicial guidance in *Santos NA Barossa Pty Ltd v Tipakalippa* [2022] FCAFC 193 (Tipakalippa Decision). The Tippakalippa Decision provides important clarification on the purpose of consultation as follows:

- Paragraph 54: The information that the titleholder is obliged to provide NOPSEMA is also designed to provide a basis for NOPSEMA's considerations of the measures, if any, that a titleholder proposes to take or has taken to lessen or avoid the effect of its proposed activity on the environment, as expansively defined.
- Paragraph 89 of the Tipakalippa Decision: …its purpose [section 25] is to ensure that the titleholder has ascertained, understood, and addressed all the environmental impacts and risks that might arise from its proposed activity. Consultation facilitates this outcome because it gives the titleholder an opportunity to receive information that it might not otherwise have received from others affected by its proposed activity. Consultation enables the titleholder to better understand how others with an objective stake in the environment in which it proposes to pursue the activity perceive those environmental impacts and risks. This enables the titleholder to refine or change the measures it proposes to address those impacts and risks by taking into account the information acquired through

consultation. This is likely to improve the minimisation of environmental impacts and risks from the activity.

In line with this guidance, Shell recognises that consultation enables the titleholder to:

- gain a better understanding of how relevant persons with an objective stake in the Planning Area perceive the environmental impacts and risks of the proposed activity.
- refine or modify the proposed control measures to minimise any environmental impacts and risks raised during consultation.

The consultation process also assists the titleholder to meet its obligation under section 280 of the OPGGS Act which requires that it must carry out the petroleum activity in a manner that does not interfere with navigation, fishing, conservation of resources of the sea and seabed, other offshore electricity infrastructure and petroleum activities, and the enjoyment of Native Title rights and interests (within the meaning of the *Native Title Act 1993* (Cth)) to a greater extent than is necessary for the reasonable exercise of the titleholder's rights and obligations.

Shell recognises that while it is required to consult with each relevant person under the OPGGS(E) Regulations, participating in consultation is not obligatory for relevant persons. The regulations do not impose any obligation to reach agreement on the subject of consultation. Shell understands there may be individuals within a community (who hold communal interests) who may be unable to participate in consultation for various reasons. The absence of their participation does not invalidate the consultation process, provided that Shell has made reasonable efforts to identify and consult with relevant persons.

To ensure that organisations and individuals who may be affected by the proposed activity are aware of Shell's consultation process and can provide feedback in accordance with the intended outcome of consultation, an adaptive consultation methodology has been implemented.

This section outlines Shell's consultation methodology for this EP including:

- application of section 25(1) of the OPGGS(E) Regulations in identifying relevant persons.
- application of the consultation methodology.
- assessment of relevant persons.
- consultation information provided to relevant persons.
- engagement with individuals or organisations contacted directly by Shell; and
- feedback received and Shell's assessment of the merit of objections or claims.

The consultation methodology set out in this EP demonstrates that Shell has undertaken consultation with relevant persons in accordance with section 25 of the OPGGS(E) Regulations. The consultation methodology incorporates Shell's increased understanding of relevant persons through updates to its known relevant persons list, experience with other EPs, and other external feedback. Other adjustments to the consultation methodology were made in response to discussions and suggestions made by relevant persons during development of this EP.

5.2 Key Principles for Consultation

Key principles for consultation in preparation of an EP in accordance with section 25 of the OPGGS(E) Regulations are outlined in Table 5-2.

Table 5-2: Key Principles for EP Consultation

Key principle	Key concept
Consultation provides an opportunity for free and open exchange of information to occur between a titleholder and relevant person that	• The process provides a genuine opportunity for relevant persons to be heard and provide feedback. • An inclusive approach is taken by which the titleholder seeks to identify and consult with relevant persons throughout the

Key principle	Key concept
may be affected by a proposed activity.	development of the EP, takes reasonable measures to allow relevant persons an opportunity to self-identify, and identifies potentially relevant persons taking a broad, rather than narrow, approach to functions, interests or activities within the Planning Area. • The process includes mechanisms for titleholders to receive information from relevant persons that they might not have otherwise received. • The process enables a titleholder to gain better understanding about the environment and measures that may be necessary to mitigate the potential environmental impacts and risks associated with the petroleum activity. • While consultation does not carry with it any obligation on the titleholder to seek or reach agreement; or obtain consent for the proposed activity the titleholder should be receptive to suggestions from a relevant person, where these may improve the overall environmental outcome. • Engagement techniques are selected based on appropriateness and tailored to the needs of relevant persons. This includes location, timing, cultural sensitivities and preferred methods of consultation.
The consultation process must be capable of practicable and reasonable discharge.	• The obligation to consult is a real-world obligation that must be construed in a practical and pragmatic way that makes a process both reasonable and workable. • Where communal interests are held, the process of consultation needs to reasonably reflect the characteristics of the communal interests affected and does not necessarily require communications with each and every person who is a member of the relevant community. • The obligation to identify relevant persons for the purpose of consultation must be capable of being discharged. This means that relevant persons must be ascertainable within a reasonable timeframe and through reasonable efforts.
Consultation involves provision of sufficient information on a proposed activity to relevant persons and allows for a reasonable period of time for a relevant person to consider the information.	• Information provided to a relevant person must be sufficient to allow them to make an informed assessment of the possible consequences of the proposed activity on their functions, interests or activities. • When determining a reasonable period for consultation, consideration is given to the nature, scale, and complexity of a proposed activity, as well as the extent of potential impacts and risks on a relevant person's functions, interests, or activities.
Relevant person participation in the consultation process is voluntary.	• The voluntary participation of relevant persons in the consultation process is respected. The titleholder collaborates with them to determine their preferred method of consultation where possible. • Relevant persons are not obligated to respond to a titleholder's request to participate in consultation. • A titleholder is not required to wait indefinitely for a response provided that sufficient information and a reasonable period of time has been afforded to the relevant person.

5.3 Regulations and Guidance

This methodology has been developed in accordance with the relevant regulations and guidelines, including:

- Tipakalippa Decision Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193

- NOPSEMA Guideline GL2086 – Consultation in the course of preparing an environment plan – May 2024 (NOPSEMA 2024a)
- NOPSEMA Guidance Note GN1847 – Responding to public comment on environment plans – January 2024 (NOPSEMA 2024b)
- NOPSEMA Guidance Note GN1344 – Environment plan content requirements – July 2025 (NOPSEMA 2025)
- NOPSEMA Guideline GL1721 – Environment Plan Decision Making Guideline – January 2024 (NOPSEMA 2024g)
- NOPSEMA Guidance Note GN1488 – Oil pollution risk management – July 2025 (NOPSEMA 2025d)
- NOPSEMA & DNP Guidance Note GN1785 – Petroleum activities and Australian Marine Parks – August 2025 (NOPSEMA 2025c)
- NOPSEMA Guideline GL1887 – Consultation with Commonwealth agencies with responsibilities in the marine area – November 2024 (NOPSEMA 2024c)
- NOPSEMA Brochure – Consultation on offshore petroleum environmental plans – May 2023 (NOPSEMA 2023b)
- NOPSEMA Policy PL2098 – Managing gender-restricted information Policy – December 2023 (NOPSEMA 2023a)
- NOPSEMA Policy PL1347 – Environment Plan Assessment Policy – January 2024 (NOPSEMA 2024e)
- Department of Climate Change, Energy, the Environment and Water (DCCEEW): Sea Countries of the North-West; Literature review on Indigenous connection to and uses of the North-West Marine Region – July 2007
- DCCEEW – Assessing and Managing Impacts to Underwater Cultural Heritage in Australian Waters: Guidelines on the application of the Underwater Cultural Heritage Act 2018 – June 2024
- DCCEEW – The Interim Engaging with First Nations People and Communities on Assessments and Approvals under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (interim guidance) – February 2023
- International Finance Corporation Performance Standard 7 – 2012
- Australian Fisheries Management Authority: Petroleum industry consultation with the commercial fishing industry – 2024
- DAFF – Guidance framework for supporting cooperative coexistence of seismic surveys and commercial fisheries in Australia's Commonwealth marine area – 2022
- DAFF – Offshore Installations Biosecurity Guide – June 2023
- Commonwealth Department of Industry, Science and Resources – Streamlining Offshore Petroleum Environmental Approvals: Program Report – February 2014
- WA Department of Primary Industries and Regional Development: Guidance statement for oil and gas industry consultation with the Department of Fisheries – 2013
- WA Department of Transport: Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: Response and Consultation Arrangements – July 2020
- WA Department of Mines, Industry Regulation and Safety – Consultation Guidance Note (for the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009) – April 2012
- Northern Territory Environment Protection Authority – Stakeholder Engagement and Consultation: Environmental Impact Assessment – Guidance for Proponents – January 2021
- Western Australian Fishing Industry Council – Consultation approach for unplanned events

- IAP2 Public Participation Spectrum

Shell has consulted with relevant persons identified in accordance with the NOPSEMA decision-making guideline (N-04750-GL1721 January 2024 (NOPSEMA 2024g)) under the OPGGS(E) Regulations for this EP.

The term 'relevant person' is defined in section 25(1) of the OPGGS(E) Regulations. This section outlines the methodology used to identify and determine relevant persons for the purposes of Section 25 (1)(a) to (e).

These requirements are summarised in Table 5-3.

Table 5-3: Division 3 – Section 25 of the OPGGS(E) Regulations

Legislation	Summary	Requirement
Part 4, Division 3—Consultation in preparing an environment plan. 25. Consultation with relevant authorities, persons and organisations, etc.	Relevant persons	(1) In the course of preparing an environment plan (including a revised environment plan referred to in Division 5) a titleholder must consult each of the following (a relevant person): (a) each Commonwealth, State or Northern Territory agency or authority to which the activities to be carried out under the environment plan may be relevant. (b) if the plan relates to activities in the offshore area of a State—the Department of the responsible State Minister. (c) if the plan relates to activities in the Principal Northern Territory offshore area—the Department of the responsible Northern Territory Minister. (d) a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan. (e) any other person or organisation that the titleholder considers relevant.
	Sufficient Information	(2) For the purpose of the consultation, the titleholder must give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests, or activities of the relevant person.
	Reasonable period	(3) The titleholder must allow a relevant person a reasonable period for the consultation.
	Sensitive information	(4) The titleholder must tell each relevant person the titleholder consults that: (a) the relevant person may request that particular information the relevant person provides in the consultation not be published; and (b) information subject to such a request is not to be published under this Part.

Source: OPGGS(E) Regulations

5.3.1 Tipakalippa Decision

In its decision handed down on 2 December 2022, the Full Court of the Federal Court of Australia considered the meaning of 'relevant person' within section 25(1)(d) of the OPGGS(E) Regulations.

The proceedings (brought by Mr Tipakalippa) challenged NOPSEMA's decision to accept Santos' Drilling and Completions EP, submitted as part of the Barossa Project. Mr Tipakalippa alleged that Santos did not consult with him or his clan and, as a result, NOPSEMA's approval was invalid.

The OPGGS(E) Regulations do not define what is meant by 'functions, interests or activities', and the construction of the words in this phrase was clarified by the Full Court. The meaning of these words is discussed in further detail in Table 5-4 below.

The Full Court also made observations on other aspects of consultation which are set out below[3]:

- Superficial or tokenistic consultation will not be enough.
- Where interests are held communally, or across a group, the titleholder has a degree of 'decisional choice' in identifying which persons are to be approached within the group, the manner of communication and the method of consultation.

The decision also clarifies that EPs must demonstrate that consultation has occurred as required by section 25 of the OPGGS(E) Regulations. In practice, this means that:

- Once titleholders have proactively identified and engaged in consultation with relevant persons, the titleholder must demonstrate to NOPSEMA that the requisite consultation has occurred, i.e. by ensuring that the EP sets out its understanding of who a relevant person is (with reference to the Full Court's reasons).
- If the titleholder has proceeded on an incorrect interpretation of the regulations, it may not be possible for NOPSEMA to be satisfied that the titleholder has carried out the consultations required by the OPGGS(E) Regulations.

5.3.2 NOPSEMA Consultation Guideline

The NOPSEMA Guideline: Consultation in the course of preparing an Environment Plan, as published on their website, clarifies the legal requirements for consultation by titleholders while preparing their EPs prior to submission to NOPSEMA.

In particular, the NOPSEMA Consultation Guideline provides guidance on the following aspects:

- the interpretation of 'relevant person' and each term in the phrase 'functions, interests or activities' as contained in section 25(1)(d) of the OPGGS(E) Regulations; and
- matters that should be considered in designing and implementing consultation processes.

5.3.3 Key Terms and Definitions

The meaning of key terms and definitions are summarised in Table 5-4 by reference to the NOPSEMA Consultation Guideline (which is informed by the Full Court's observations in the Tipakalippa Decision).

Table 5-4: List of Key Definitions

Term	Definition
Activities	In relation to section 25(1)(d) of the OPGGS(E) Regulations, activities are considered to be what other persons or organisations are already doing.
Activity Area	The Activity Area is defined as the Petroleum Permit Area WA-44-L and WA-2-IL.
Claims	Assertion or information about the potential adverse impacts from the petroleum activities to which the EP relates.
Environment	The OPGGS(E) Regulations define this as: • ecosystems and their constituent parts, including people and communities; and

[3] Since the Tipakalippa Decision was handed down, section 25 of the OPGGS(E) Regulations has been the subject of two further Federal Court decisions (Cooper v NOPSEMA [2023] FCA 1112; Cooper v NOPSEMA [2023] FCA 1158). The Federal Court's observations on the requirements of consultation in the Cooper proceedings are consistent with the Tipakalippa Decision and emphasise the importance of consultation in ensuring that titleholders provide NOPSEMA with relevant information about the environmental impacts and risks of a proposed activity.

Term	Definition
	• natural and physical resources; and • the qualities and characteristics of locations, places and areas; and • the heritage value of places; and includes • the social, economic and cultural features of the matters mentioned in paragraphs (a), (b), (c) and (d).
Functions	In relation to section 25(1)(d), functions refer to a power or duty to do something.
Interests	In relation to section 25(1)(d), 'interest' includes an interest possessed by an individual, whether or not the interest amounts to a legal right or is a proprietary or financial interest or relates to reputation. However, an interest does not extend to general public interest in an activity, it must be an interest over and above a member of the public at large[4].
Nature and scale of effect on relevant persons functions, interests or activities	This is a broad screening assessment done for some selected relevant persons where a clearer distinction is warranted between the nature of a relevant person's functions, interests or activities that may be affected. This is split into two categories: High (nature and scale): Planned impacts which may be significant will occur to a known interest such as a cultural value or feature. Impacts are likely to be long term. Low (nature and scale): Impacts are either from highly unlikely events, such as a major spill or planned impacts are not likely to be significant, nor long term and does not involve the direct desecration of a cultural feature.
Objection	A reason or argument about the potential adverse impacts arising from the petroleum activities to which the EP relates.
Planning Area	This is the environment that may be affected (EMBA) by the activity. The spatial extent of the Planning Area is determined from stochastic spill modelling or National Energy Resources Australia (NERA) reference cases using the low hydrocarbon exposure thresholds (no ecological impact) as recommended by NOPSEMA. Note, the Planning Area does not define the area of affect to a relevant person's functions, interest or activities, but instead it is used as an initial input to develop a broad list of possible relevant persons that may be affected in a geographical area for the activity. Each potentially relevant person is then further assessed in direct context of the effect the activity may have on their own specific functions, interests and activities.
Reasonable period	A reasonable time for relevant persons to identify the effect of a proposed activity on their functions, interests or activities and provide a response detailing their objections or claims. Shell generally considers a reasonable period for a relevant person to review and provide an initial response as being 30 calendar days, subject to the nature and scale of the proposed activity. However, Shell has provided Indigenous relevant persons with a minimum consultation period of three months. Where dialogue with relevant persons is ongoing after this period, Shell will continue to consult until Shell believes it has provided these persons with sufficient information and a reasonable period to respond which merits consultation to close.
Reasonable efforts	During the consultation period, Shell will make all reasonable efforts to make contact with all identified relevant persons for the EP (where a reasonable and workable avenue exists). Shell recognises that specific consultation channels to pass on information may be more appropriate for certain groups of relevant persons.
Relevant matter	The matter raised does not fit the criteria descriptions for objections or claims with/without merit. However, the matter raised is relevant to the activity, comprises a request to Shell for

[4] Tipakalippa Decision, paragraph [154]

Term	Definition
	further relevant information, or provides information to Shell that is relevant to the activity or the EP.
Not a relevant matter to this EP	Input does not relate to the activity or the relevant person's functions, interests or activities affected by the activity. Matters that are not relevant may also be generic in nature with no specific issues raised (e.g. salutations, acknowledgements, meeting arrangements, etc.).
Relevant person	Can be a person, organisation, department agency, authority or State Minister that falls within one of the categories defined by section 25(1) of the OPGGS(E) Regulations, whose functions, interests or activities may be affected by the activities to be carried out under the EP.

5.4 Identifying Relevant Persons

Shell's approach to identifying relevant persons for this EP aligns with guidance provided in the NOPSEMA Consultation Guideline. This process is designed to ensure a broad and inclusive capture of individuals and organisations whose functions, interests, or activities may be affected by the proposed activity. Shell recognises that relevant person identification is iterative. New relevant persons may be identified during consultation or after EP submission. Nonetheless, Shell has done extensive work to ensure relevant persons are identified in the course of preparation of this EP, in compliance with section 25 of the OPGGS(E) Regulations, outlined further in this EP.

5.4.1 NOPSEMA Consultation Guideline

The process must provide for sufficiently broad capture of ascertainable persons and organisations whose functions, interests or activities may be affected by the activity.

- The process should include reference to multiple sources of information, such as publicly available materials, review of databases and registers, published guidance, previous history, as well as advice from authorities and other relevant persons.
- Titleholders must clearly identify in their EPs who is a relevant person and the rationale the titleholder has used to determine who they consider falls within that definition.

5.4.2 Identification steps

The following steps were used to identify relevant persons (Table 5-5):

1. An assessment of the proposed EP and its associated planning area, including its environmental, cultural, economic and social attributes.
2. A comprehensive research methodology to identify and assign relevant persons to a thematic group (see Section 5.5).
3. Advertisements in local, regional and national print, social media and radio to allow for a broad capture of relevant persons.

This was supported by:

- encouragement of identified relevant persons during engagement activities, such as community sessions as outlined in this EP, to share and communicate with those who they may think were relevant.
- self-identified relevant persons.
- information shared with Shell through other third parties (such as industry).
- Shell's workflow for identifying and consulting with relevant persons is illustrated in Figure 5-1. The process includes:
  - **Steps 1–17**: Identification, categorisation, and engagement

- **Steps 18–25**: Assessment of objections, claims, and relevant matters. Further detail on the assessment of merit is provided in **Section 5.9**.

Table 5-5: Identification Considerations

Considerations	Justification
Planning Area	Shell used oil spill modelling to assist in the process of identifying potentially relevant persons for this EP. Shell adopted a conservative approach to this modelling. If less conservative and, arguably, more appropriate oil spill modelling was used, the Planning Area would be significantly reduced and therefore fewer potentially relevant persons would have been identified. In May 2025, during the consultation process, the Planning Area for this EP was re-assessed with advanced spill modelling. This saw a reduction in Planning Area at the Northeastern end and a slight extension in Planning Area towards Christmas Island. As a result, relevant persons were re-assessed and adjusted as required.
New information	During the consultation process, new information may become available to inform the extent of effect of Shell's activity on a person's functions, interests or activities, which may result in an identified relevant person being removed from the relevant persons list. For example, new information may become available which further informs/clarifies a person's actual functions, interests or activities and how they could be affected which are not to the extent as previously perceived by Shell during the initial identification process.
Lack of environmental or ecological impact	There may be persons who have functions, interests or activities within the Planning Area at the initial time of submission, but those functions, interests or activities may not be affected by Shell's activities. Where no environmental or ecological impacts are predicted within a geographical area, there can be no corresponding impacts on a person's functions, interests or activities. There may also be instances where potential environmental or ecological impacts are predicted to occur within an area; however, despite a geographical overlap this will not necessarily equate to an impact on a person's functions, interests or activities.
Contact details not ascertainable	Shell may identify a group of relevant persons who are potentially affected but is unable to confirm individual contact details if these are not ascertainable through normal mechanisms (e.g. associated government agencies, organisations or groups who hold these details or who can advise who these individuals are). In this case, consulting with such relevant persons cannot reasonably be discharged within a reasonable time due to the 'opacity as to the identity of those with whom consultations are to take place' (refer Tipakalippa Decision Paragraph 136, Section 5.3.1). In this scenario, the opportunity exists for such persons to contact Shell via its publicly accessible website or advertising campaign.

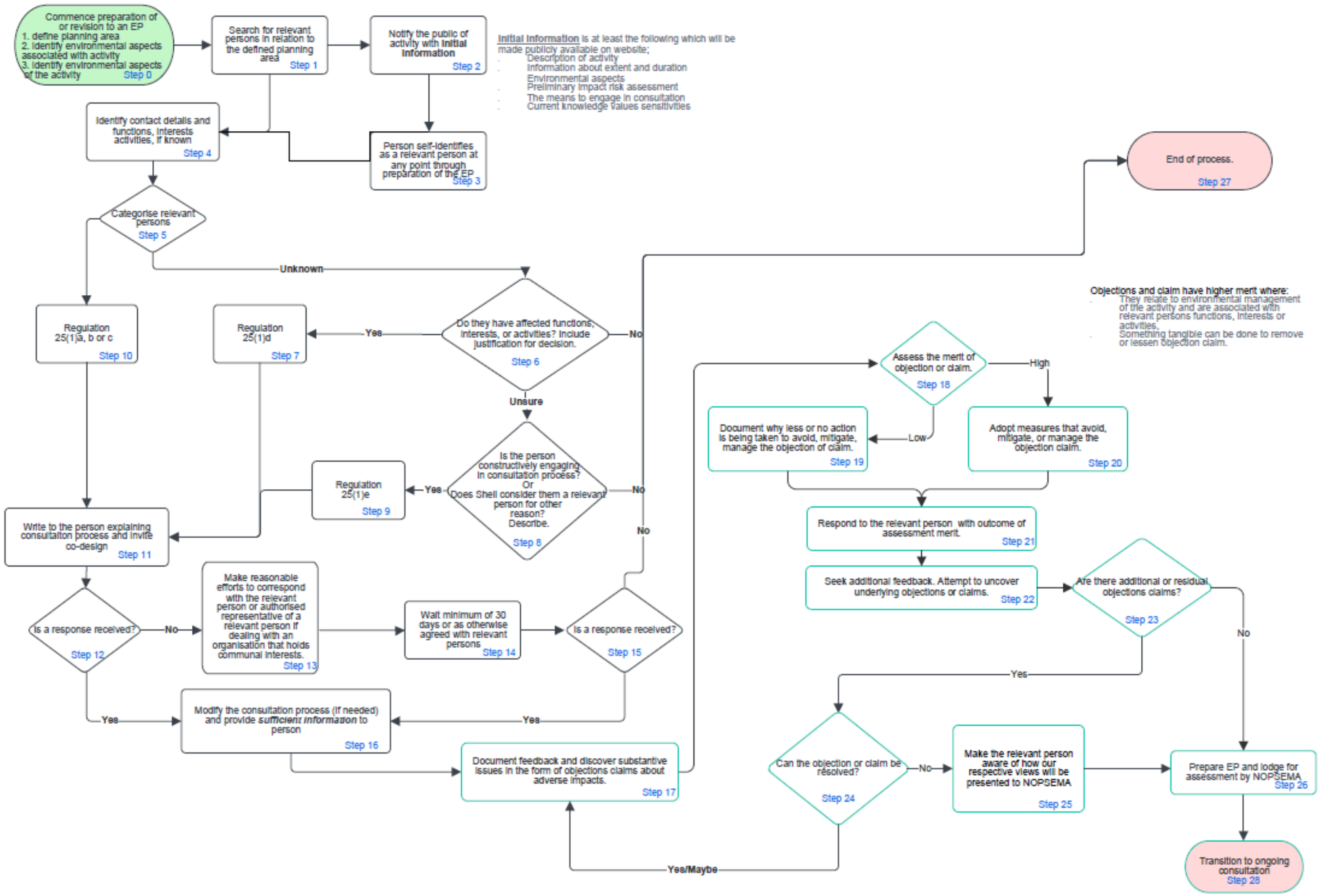


Figure 5-1: Relevant persons workflow

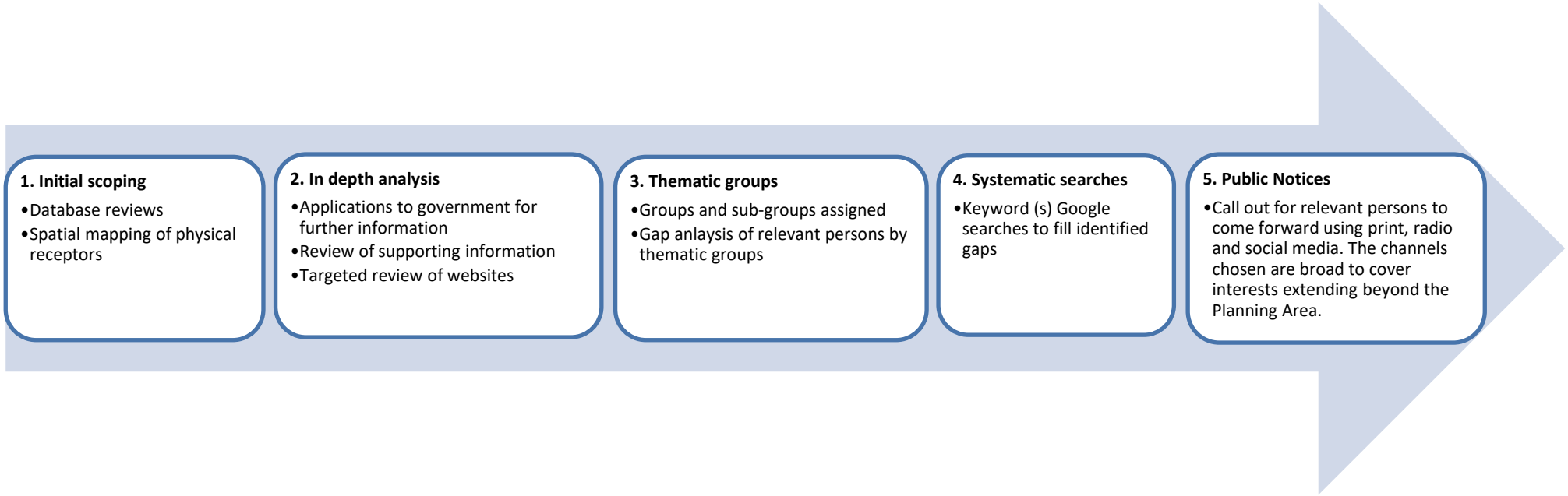


Figure 5-2: Methodology for the Identification of relevant persons

5.5 Description of Research Methodology

Table 5-6 presents the research methodology used to identify relevant persons. A comprehensive review was conducted in January – March 2023 using a range of research activities to inform the identification of relevant persons. This was then reviewed in late 2024 prior to consultation for this EP, incorporating data gathered from other EP consultation.

Table 5-6: Research Methodology

Research Activity	Detail
1. Existing Shell Australia database reviews	Shell holds an extensive database of individuals and organisations identified for projects and ongoing operations, including for the Prelude FLNG facility and the Crux platform located ~160 km from Prelude. In January 2023, existing relevant person datasets and associated recent relevant persons correspondence were reviewed and merged into a register of potentially relevant persons. This register was reviewed again in late 2024 ahead of commencement of consultation for this EP.
2. Review of public databases and spatial mapping of datasets	A comprehensive review of publicly available databases was undertaken to identify physical receptors, environmental, social and cultural values and sensitivities overlapping with the Planning Area and a further 50 km buffer zone. This extended buffer was applied to ensure coverage beyond the Planning Area, allowing for the identification of relevant persons or values located near the edge of the Planning Area. Searches of public databases were also undertaken for cultural heritage (Indigenous and non-Indigenous). Searches included the following: • **National Native Title Tribunal (NNTT)**: register of Native Title Registrations, Claims, Determinations (including Prescribed Body Corporates (PBCs) and Registered Native Title Bodies Corporate (RNTBC) for the determinations), Future Acts and Indigenous Land Use Agreements. • **Spatial data from NNTT:** database used to identify Land Councils and NT Aboriginal Trusts, and any additional Native Title material relevant to the Planning Area. • **Protected Areas**: including legislated lands and waters of WA and NT (e.g. Commonwealth and National Parks and Reserves), WA Lands of Interest, RAMSAR Wetlands, Australian Marine Parks, Indigenous Protected Areas (IPAs). • **Heritage Areas**: including world and national heritage listed places, WA Heritage Council State Register, WA Heritage List, WA Heritage Council Local Heritage Survey, NT Heritage Register. • **WA Aboriginal Cultural Heritage database:** including the WA Aboriginal Cultural Heritage Survey database (where available information on knowledge holders was also extracted.) • **Aboriginal Areas Protection Authority (AAPA):** application requesting Abstract of Record for the Planning Area within Territorial waters. • **Petroleum licence holders:** exploration and operations licence holders. • **Key Ecological Features (KEFs) and Biologically Important Areas (BIAs).** • **Underwater Cultural Heritage (UCH):** including the Australasian UCH Database.

Research Activity	Detail
	• **Local Government Authorities and Town Councils.** • **Population centres**: including Indigenous communities (Indigenous, remote, town based, seasonal and permanent). • **Military land.** • **Commonwealth, state and territory fisheries, aquaculture licence holders and pearl lease holders.** • **Spatial mapping of datasets:** enabled an understanding of overlaps with the Planning Area.
3. Review of background reports and supporting information for database searches	Building on the outcomes of the initial database searches (refer to research activity 2), relevant supporting information was accessed and reviewed to inform the identification of potentially relevant persons and organisations, their functions, interests, or activities. Key supporting information reviewed included: • Native Title application documents and any associated court documents, Indigenous Land Use Agreements (ILUAs) and Future Acts. This review identified potentially relevant RNTBCs, PBCs and RATSIBs organisations as well as individual Indigenous People and family groups. Saturation was reached once all identified Native Title claims, determinations etc. within the Planning Area (including the additional 50 km buffer) were exhausted. • WA Aboriginal cultural heritage survey reports overlapping with the Planning Area. Research organisations, Indigenous organisations and Indigenous Knowledge Holders were identified as potentially relevant persons. This review informed an understanding of overlapping cultural and social values in the Planning Area. • Management plans associated with identified protected areas, KEFs and BIAs, such as Australian Marine Parks. This process identified relevant persons (people and organisations) including Indigenous Groups with research interests in the marine environment. • Management plans and future application plans for all identified IPAs. • Healthy Country Plans for all Land Councils identified through database searches. • WA State of the Fisheries Report (2023/24) (Newman et al. 2023) with a focus on the WA fisheries overlapping with the Planning Area and Bio Regions. • Commonwealth Fisheries reports.
4. Review of research journals	An online search for journal articles related to Saltwater People, Totems and Indigenous use of Sea-Country was conducted to inform an understanding of cultural values potentially overlapping with the Planning Area. This process also identified potentially relevant persons (persons and organisations) (e.g. Indigenous groups who identify as Saltwater People).
5. Targeted review of websites and other sources associated with Indigenous Organisations	In addition to searches and assessments listed in research activity 2–4, representation searches were also considered: • By whom and what organisation as well as legal standing of the organisation

Research Activity	Detail
	• Parties to ILUAs that have since had a Native Title determination made over the Planning Area • If an Aboriginal Corporation was an appointed Local Aboriginal Cultural Heritage Services • A targeted review of all Land Council, RNTBC and PBC websites and social media platforms was undertaken to identify potentially relevant persons (persons and organisations) and their functions, interests or activities overlapping the Planning Area Importantly, this process enabled the outcomes of the KEFs and BIA database searches (refer to research activity 2) to be considered within the context of Indigenous cultural values (i.e. totems, cultural activities and Indigenous land and resource use activities). This process informed the identification of some geographically remote organisations as potentially relevant persons.
6. Targeted review of websites for peak bodies	A targeted review of websites and social media platforms associated with a range of peak bodies, representing interests identified through database searches (e.g. recreational fishing, commercial fishing, Commonwealth fisheries) was undertaken to confirm functions, interests, or activities, and to identify additional and related potentially relevant persons (persons and organisations) and their functions, interests or activities overlapping the Planning Area. This review included recreational and commercial fisheries including aquaculture activities.
7. Targeted review of websites for Local Government Authorities	A targeted review of the websites and social media platforms associated with Local Government Authorities identified through the database searches and spatial mapping was undertaken to identify additional potentially relevant persons and to scope functions, interests, or activities of each relevant local government authority. This process, representing interests identified through database searches (such as recreational fishing, commercial fishing, Commonwealth fisheries), was conducted to confirm functions, interests, or activities, and to identify additional and related potentially relevant persons and organisations, and their functions, interests or activities overlapping with the Planning Area.
8. Review of local community directories	Where available on the internet, a search of local community services directories for each Local Government Area with an area intersecting the Planning Area for potentially relevant persons (people and organisations) and associated functions, interests or activities was conducted. This process identified a number of interest groups, service providers, sport and recreation organisations as well as accommodation providers.
9. Targeted keyword search for Indigenous and non-Indigenous commercial operations	An online search for potentially relevant persons and organisations using key words and place-based search terms (e.g. fish + Darwin) was conducted. Table 5-7 lists the key search terms used.
10. Broad based keyword search	Online searches for potentially relevant persons (persons and organisations) were deployed systematically, with search terms such as 'Darwin + tourism'. Table 5-7 lists the key search terms used. Search results were interrogated until limitations became evident.
11. Public advertising campaign and engagement with identified relevant persons	Shell also sought to identify potentially relevant persons by placing advertisements in local, regional, and national print, social media and broadcast media.

Research Activity	Detail
	During engagement activities, such as community sessions outlined in this EP, Shell also encouraged relevant persons to share and communicate with those whom they considered may be relevant and those who self-identified.

Table 5-7: Key Internet Search Terms

Search Terms
beach accommodation + Broome /Kimberley /Dampier Peninsula
beachfront accommodation + Broome /Kimberley /Dampier Peninsula
bird watching + Broome /Kimberley /Eighty Mile Beach /Dampier Peninsula
Broome + helicopter
Broome academic + research organisation
caravan parks + Kimberley + Western Australia
coastal accommodation + Kimberley Western Australia
commercial fishing + Western Australia
conservation + Broome /Kimberley /Dampier Peninsula
cultural experiences + Broome
fishing tours + Broome
Indigenous Protected Areas + Australia
Land Council + Western Australia
[name of Local Government] + community directory
Native Title + Western Australia
ocean views hotel + Broome /Kimberley /Dampier Peninsula
Sea Country + Totems
Sea Country + Western Australia
surf + Broome /Kimberley /Dampier Peninsula
surf lifesavers + Broome /Kimberley /Dampier Peninsula
things to do + Broome /Kimberley /Dampier Peninsula
tourism + Beachfront accommodation + Broome /Kimberley /Dampier Peninsula
tours + Broome
volunteer and emergency services + Broome
water sports + Kimberley + Western Australia
watersports or water sports +Broome /Kimberley /Dampier Peninsula

During the initial scoping task, each identified potentially relevant person was assigned to a thematic group. Two thematic groupings of relevant persons were identified as having particularly defined functions, interests, and activities within the Planning Area: Indigenous People and commercial fishing operators.

Further and targeted effort was taken to identify relevant persons within each of these thematic groups. An additional four thematic groups, being international persons, Indonesian traditional fishers, commercial

operators and interest groups, were also identified as having potentially relevant persons (particularly organisations) with defined interests and activities within the Planning Area. Further efforts were applied to identify relevant persons in these thematic groups.

Sections 5.5.1 to 5.5.6 describe the methodology for the identification of relevant persons in the thematic groups and the relevance of these groups for this EP.

5.5.1 Indigenous People

Shell has a history of engaging with Indigenous People at various levels, including local communities, Indigenous groups (Native Title determined or otherwise), and governing bodies. Shell has a deep appreciation and respect for the Traditional Owners and Custodians of the land and seas where it operates. For the purposes of reporting on consultation, people and organisations with attributes described above are collectively referred to as Indigenous People.

Offshore projects intersect heavily with Sea Country – a part of the landscape that is equally important to Indigenous People as Land Country. Many elements within Sea Country are deeply rooted in Indigenous cultures, including their history and creation stories. Marine life, cultural sites, and places of significance are directly connected to the wellbeing and everyday life of Indigenous Peoples. Furthermore, the health and wellbeing of Sea Country is one and the same as the health and wellbeing of Indigenous People themselves. The approach to the identification of Indigenous People as relevant persons is guided by their cultural and spiritual connection to Sea Country.

Additional methods (apart from those described in Figure 5-2) of identifying Indigenous People that may be relevant persons included the following activities:

- Identification and review of the total values and sensitivities of the physical environment that may be affected by the planned activities for this EP, including the spatial extent of the activities.
- Desktop research to identify any published Sea Country research (including anthropological reports where available) that could identify marine and avian species that may represent spiritual totems, relevant to the activities in the EP.
- Review of available Indigenous cultural heritage survey reports (including ethnographic reports) and supporting information for selected Indigenous cultural heritage sites identified within the Planning Area.
- Further research based around subgroupings as described below.
- Direct requests to relevant land councils or representative bodies to further identify any relevant persons.

Any person identified by another relevant person or representative body where they consider it appropriate for cultural or other reasons (i.e. ownership of a particular site).

Shell acknowledges that existing data or information relating to Sea Country values and sensitivities in both public and from other sources is currently limited and does not exist to the same degree as research on Land Country.

5.5.1.1 Native Title Holders

Native Title recognises the traditional rights and interests to land and waters of Indigenous People. Native Title Holders are recognised by Australian legal systems as holding rights and interests (which may be exclusive or non-exclusive) in relation to land and sea within determination boundaries. For the purposes of the relevant persons identification process, all Native Title applications, determined or otherwise, were regarded as relevant. The identification process was extended beyond the western construct of mappable boundaries and approached the concept of relevance of Indigenous groups and individuals with a degree of flexibility. Where one group's Native Title boundaries may not intersect with the Planning Area, they may still hold values and interests within the Planning Area. To this end, initial searches conducted included all Native Title applications and determinations within a further 50 km buffer added to the Planning Area.

Using spatial data from the NNTT database, all relevant Native Title information (i.e. applications, registrations, determinations and ILUAs) were extracted for the Planning Area. All applications, supporting information

(where available) and court outcomes (where available) were interrogated. Saturation was reached once all identified Native Title applicants and holders within the Planning Area (including the additional 50 km buffer) were exhausted.

The names of Native Title applicants and holders were identified on the extracted Native Title information. Identified relevant persons included individuals and organisations (drawing on the NOPSEMA Consultation Guidelines that relevant persons can be individuals, organisations, or groups).

5.5.1.2 Native Title and Indigenous Representative Bodies

Using the same process as described in Section 5.5.1.1, together with the strong working knowledge of Native Title and Indigenous governance structures held by Shell personnel, Native Title Representative Bodies (NTRBs), Prescribed Bodies Corporate (PBCs), Registered Native Title Bodies Corporate (RNTBCs) and Native Title Service Providers (NTSPs) were identified. NTRBs and NTSPs are funded by the National Indigenous Australians Agency to assist Native Title claimants and holders. NTRBs and NTSPs can also be referred to as Representative Aboriginal/Torres Strait Islander Bodies (RATSIBs).

NTRBs and NTSPs were generally identified directly from the NNTT catalogue entries and included the Northern Land Council (NTRB) within the Northern Territory RATSIB Area, Kimberley Land Council (NTRB) within the Kimberley RATSIB Area. These NTRBs have a function in relation to the administration of Native Title and may represent Native Title applicants and holders' interests in relation to existing Native Title claims and determinations that extend into Sea Country. They may also be the contact point for specific RNTBCs, PBCs or Native Title applicants for the purposes of consultation. Where this is the case, it is identified for the particular person or organisation in Appendix B.

5.5.1.3 Land Councils

Aboriginal Land Councils (Land Councils) assist Indigenous Peoples to negotiate with governments and private companies over projects on Aboriginal land. Land Councils also support Indigenous Peoples to manage their land and sea, including issuing permits to enter, fish, film and perform other activities on Aboriginal land. Shell carried out database searches of Land Council boundaries in WA and NT, and Land Councils with areas intersecting the Planning Area were identified as potentially relevant persons. Saturation was achieved through spatial mapping and the identification of Land Council areas with borders or that overlap with the Planning Area.

Systematic searching of the websites of potentially relevant Land Councils enabled further interrogation of potential functions, interests, or activities. Land and Sea Ranger Groups and programs associated with Land Councils were identified through these searches. Healthy Country Plans were also identified and reviewed and provided vital information to understand values and sensitivities (e.g. Sea Country use and/or totems that potentially overlap with the Planning Area).

5.5.1.4 Aboriginal Trusts

Aboriginal Trusts were established under the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) (ALRA). The ALRA recognises the traditional ownership and occupation of the land by Indigenous People and the importance of their connection to land. In the NT, Traditional Owners can be granted Aboriginal freehold land ownership under the ALRA. The ownership of this land is held by Land Trusts, which are in turn managed by Land Councils.

Under the ALRA, Traditional Owners have exclusive rights over their land and may impose conditions on how the land is used (should they agree to an organisation using it). Spatial mapping of Aboriginal freehold land across the NT, and the identification of the associated Aboriginal Trusts was undertaken as part of the search for potentially relevant persons. This included a search for any Aboriginal Trusts associated with Aboriginal freehold land that intersected with or was adjacent to the Planning Area.

5.5.1.5 Aboriginal Corporations

Aboriginal and Torres Strait Islander Corporations (Aboriginal Corporations) are registered under the *Corporations (Aboriginal and Torres Strait Islander) Act 2006* (Cth) and include RNTBCs. The identification of Aboriginal Corporations was conducted primarily through the desktop review of Traditional Owner websites

and Healthy Country Plans. When a Traditional Owner group did not have a website, searches were conducted through search engines and social media to identify Facebook accounts and/or news or media articles.

5.5.1.6 Family Groups and Individuals

Family groups and individuals were identified independently of Native Title information. The rationale for this is based on the Tipakalippa Decision; that family groups and individuals may hold different values and interests from those of the Native Title applicants and holders as a collective group. These relevant persons are difficult to identify through desktop research. Other communication channels, such as public advertisements and community consultation were also used to enable relevant persons to self-identify. The list of relevant persons was derived from a comprehensive review of Native Title information, Healthy Country Plans, Land Council websites, plans of management for protected areas including National Parks and Marine Parks, WA Aboriginal cultural heritage survey reports, government websites, media and community consultation as further described in Section 5.6. An abstract of records for all land intersecting with the Planning Area from NT AAPA provided further information used to identify potential sacred sites (recorded and registered) and enable sourcing of knowledge holder information.

5.5.2 Commercial Fisheries

Commercial fishers are among the primary relevant persons whose activities may be affected by the proposed activities in the Planning Area.

Shell used a variety of resources, including data files and fishery reports, to identify relevant persons according to the criteria set out above. The method of identifying potential commercial fishers that may be relevant persons included the following activities:

- Identified and mapped designated State, Territory (where available) and Commonwealth Fisheries overlapping with the Planning Area and identified spatial overlaps with the Planning Area.
- Identified concession holders for overlapping Commonwealth Fisheries and obtained concession holder contact details from AFMA (letters were sent to all in the EP Planning Area).

For WA Managed Fisheries:

- Identified 60 Nm fish cube areas overlapping with the Planning Area and applied to DPIRD for effort and catch data for each WA fishery for fish cubes that were within a planned impact area (e.g. noise) based on modellings.
- Obtained concession holder contact details for overlapping WA Managed fisheries within the EP Planning Area (letters were sent to all in the EP Planning Area).
- Applied to NT Fisheries for information on effort and catch data and concession holder contact details within the identified NT commercial fisheries.
- Reviewed the WA State of the Fisheries Report 2023/24 (Newman et al. 2023) to inform an understanding of effort and catch in the identified WA fisheries, including permit holders.
- Systematic online search and review for the websites of peak commercial fishing industry bodies including Western Australia Fishing Industry Council Inc (WAFIC), Northern Territory Seafood Council and the Northern Prawn Fisheries Industry.
- Engagement with WAFIC, Tuna Australia and other fishing industry associations to assist in identification and consultation with relevant managed fisheries.

5.5.3 International Persons

The Planning Area also overlaps international waters of southwest Indonesia and Timor-Leste, and, in the event of a worst-case hydrocarbon spill, residual entrained hydrocarbons may reach the coastlines of Lombok and Sumba, Sabu and Raijua Islands of Indonesia. With the Indonesian and Timor Leste coastlines within the Planning Area, Shell contacted DFAT as the Government Agency with responsibility for country-to-country matters and they advised to contact the Indonesian Embassy. Shell consulted with the Indonesian Embassy including meeting with them in person on 13 March 2025. They have been provided with sufficient information and followed up with additional information. The Indonesian Embassy indicated that should any further information be required, they would contact Shell.

The purpose of oil spill modelling, consistent with the NOPSEMA procedure on oil pollution risk management guidance (GN1488), 'is purely for the evaluation of oil pollution risks and to inform preparedness and response planning for oil spill risk management' (NOPSEMA 2025). Although Shell chose to use the Planning Area to help understand the geographic extent of its risks, and subsequent consultation of relevant persons in Australia, the approach for consulting with Indonesia was discharged via consultation with the Indonesian Embassy for the following reasons:

Low impact and low likelihood: Major vessel collision spills are very unlikely, with an oil spill frequency (per vessel per hour at sea) ranging from 1.4e−08 to 6.4e−08 depending on the vessel type (DNV 2011). The worst-case credible oil spill model results predict there is a <6% probability of floating or entrained hydrocarbons reaching international coastlines at >10g/m2 in the event of the worst-case heavy fuel oil spill scenario and <1% probability of contact with international shorelines (Indonesia and Timor) for other spill scenarios. In addition, Shell puts a high focus on vessel collision prevention and emergency response to further reduce the likelihood and extent of potential impacts.

Spill Modelling used is highly conservative: Appendix D discusses model conservatisms and limitations.

By necessity over such a large domain, the model incorporates many simplifications that lead to over prediction of oil concentrations. The further away from the source, errors are compounded, particularly in nearshore areas where many physical processes are omitted (e.g. coastline resolution, surface waves, intertidal wetting and drying, refloating of oil, etc). Predictions of shoreline contact are therefore highly conservative. The modelling also does not take into consideration any spill prevention and mitigation that would be implemented in response to an incident discussed above.

Negligible nature and scale of the effect on functions, interests or activities of relevant persons in Indonesia or Timor Leste: The nature and scale of effects on the functions, interests or activities of persons in Indonesia and Timor Leste is predicted to be negligible. In addition, the Indonesian and Timor-Leste coastlines are over 300 km away from Prelude.

Shell does not consider it proportionate or reasonable for more specific, targeted consultation to occur, beyond what Shell has already carried out. To do so would require extensive efforts by Shell (from both a time and resourcing perspective), given the geographical area and size of the population concerned, which Shell estimates to be >100 million people. Shell's position is that further consultation efforts would be unworkable and beyond what is considered reasonably practicable.

The opportunity for relevant persons outside of Australia to provide ongoing feedback will also be available moving forward through the EP webpage and relevant matters and other inputs can still be considered by Shell through its ongoing consultation process (see Section 5.11), including updates of the EP through the MOC process as required and outlined in Section 10.4.4.

5.5.4 Indonesian Traditional Fishers

As described in Section 7.9.2 the Activity Area and Planning Area both overlap the MoU Box. However, Indonesian traditional fishing effort is focussed on shallow waters such as those at Seringapatam Reef and the Scott Reef complex where target sedentary reef-species are generally encountered, rather than the deep waters of the Activity Area.

The MoU Box overlaps Australian waters, and the majority of traditional fishing activities occur at reefs and islands within AMPs whose values are described in Section 7.3.1.2. The AMPs are managed by the Director of National Parks with whom Shell has consulted for this Activity.

During consultation with AFMA for previous Crux EPs, AFMA confirmed to Shell that it does not directly license or regulate the traditional fishers that may be operating in the MoU Box, nor do they maintain a register of contact details for the Indonesian traditional fishers. As there is no requirement for traditional fishers to be licensed by either the Australian or Indonesian governments, there is no publicly available information to identify these individuals. Through consultation with DFAT, Shell was advised to consult with the Indonesian Embassy, which it did.

The obligation to identify relevant persons for the purpose of consultation must be reasonably capable of discharge within a reasonable time and all relevant persons must be ascertainable. Based on the opacity as

to the identity of any Indonesian traditional fishers operating within the MoU Box, Shell has not been able to identify or contact them in a manner which is considered to be both reasonable and workable.

This is an example of where Shell has identified a group of relevant persons that may be potentially affected. However, Shell is unable to confirm individual contact details as these are not ascertainable through normal mechanisms (e.g. associated Australian government agencies, organisations or representative bodies who may hold these contact details). As such, consulting with such relevant persons is not capable of being discharged within a reasonable time due to the 'opacity as to the identity of those with whom consultations are to take place' (refer Tipakalippa Decision Paragraph 136 and Section 5.3.1).

Nevertheless, it can be inferred that the interests of traditional fishers (healthy fish communities) would be the same as those licensed commercial fishers operating in Australia that Shell has been able to contact via Commonwealth and State/Territory agencies such as AFMA, WA DPIRD, DAF-NT and WAFIC. It is considered that feedback received by Shell, in relation to potential impacts to fish communities and harm to fish stocks, would be similar to traditional fishers in the MoU Box who share the same interests.

Consultation outcomes from Commonwealth and State/Territory agencies in relation to commercial fisheries included some aspects of Shell's preparedness in response to an unplanned oil spill event and impacts to fisheries. Shell has an operational and scientific monitoring plan (OSMP) which includes suitable monitoring programs to determine the impact of oil spill on commercial, traditional and recreational fisheries, which includes various assessments depending on type, nature and scale of the spill. In the event of an unplanned oil spill, consultation with the Indonesian government will be managed by DFAT.

5.5.5 Commercial Operators

Commercial operators form a large group of identified relevant persons for this EP and include Indigenous and non-Indigenous tourism operators and marine transport operators. Commercial operators were primarily identified through online searches (including purposive and snowballing searching) coupled with expert and local knowledge. Online searches were deployed systematically with search terms (see Table 5-7 for a list of key search terms used). Search results were interrogated until saturation became evident.

5.5.6 Interest Groups

Interest groups form a large proportion of relevant persons who are difficult to identify through desktop research. Interest groups are defined as casual and formal collections comprised of members of the public who have an interest that lies within the Planning Area. Examples of formal interest groups include conservation and environment focused groups as well as activity-based groups (e.g. Fishing Clubs). Examples of casual interest groups include bird watchers, wreck divers, and history enthusiasts.

Identification of these relevant persons was conducted in two ways: through local knowledge of interest groups likely to exist in the Western Australian setting, and through Google searching key terms (described elsewhere). Saturation is difficult to reach and identify in this category through desktop research alone. Therefore, community consultation and interrogating hyper-local knowledge was a critical element of the identification process.

5.6 Identification of Relevant Persons by Category

The relevant persons identified for this EP as related to the OPGSS(E) Regulations, including the rationale for inclusion, are described in Assessment of Relevant Persons for this EP

Table 5-8. The research methodology used by Shell to identify relevant persons is described in Table 5-6. Sections 5.6.1 and 5.6.4 detail specific categories of relevant persons referred to in section 25 of the OPGGS(E) Regulations.

5.6.1 Relevant Persons – Section 25(1)(a), (b) and (c) of the OPGGS(E) Regulations

These sub-sections of the OPGGS(E) Regulations include the following as relevant persons:

(a) each Commonwealth, State or Northern Territory agency or authority to which the activities to be carried out under the environment plan may be relevant.

(b) if the plan relates to activities in the offshore area of a State—the Department of the responsible State Minister.

(c) if the plan relates to activities in the Principal Northern Territory offshore area—the Department of the responsible Northern Territory Minister.

5.6.2 Relevant Persons – Section 25(1)(d) of the OPGGS(E) Regulations

Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under an environment plan are relevant persons under section 25(1)(d). Relevant persons considered by Shell to meet the requirements of section 25(1)(d) have been identified based on:

- An assessment of the totality of the relevant environment, values and sensitivities and potential activity impacts and risks.
- The overlap of functions, interests, or activities with the Activity and Planning Areas.
- Desktop research, as summarised above.
- Advertisements and other public publications and broadcasts, described below.

The list of relevant persons was further refined as consultation progressed, including any additional relevant persons that self-identified through the broadcast and print media advertising campaign.

5.6.3 Relevant Persons – Section 25(1)(e) of the OPGGS(E) Regulations

Relevant persons under section 25(1)(e) include any other person or organisation that the titleholder considers relevant. Shell considered whether persons or organisations who self-identified should be identified as relevant persons under this category (if they did not already come within section 25(1)(d)). This consideration is further detailed in Table 5-8.

5.6.4 Not Relevant Persons

Where Shell received feedback related to general project or business operations, these questions or comments were responded to and managed as part of Shell's standard community consultation mechanisms and processes. Most of these queries related to job opportunities or enquiries on becoming a supplier to Shell. All persons who self-identified through the public advertisement campaign, were provided an information pack, including information sheets on the EP, to enable them to determine whether their functions, interests or activities would be impacted. Where no further response was received, these persons were not categorised as relevant persons for the purposes of this EP.

5.7 Assessment of Relevant Persons for this EP

Table 5-8: Assessment of Relevant Persons for this EP

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Commonwealth and State Government Departments or Agencies				
Aboriginal Areas Protection Authority NT (AAPA)	Non-Government Organisation	AAPA is an independent statutory authority established under the *Northern Territory Aboriginal Sacred Sites Act*. The Authority is responsible for overseeing the protection of Aboriginal sacred sites on land and sea across the NT.	Yes	25(1)(b)
Australian Border Force (Maritime Border Command)	Maritime	Responsible for maritime security. Deters and prevents illegal activities in the Australian Marine Domain.	Yes	25(1)(a)
Australian Communications and Media Authority (ACMA)	Media	Responsible for matters relating to maritime communications and licensing, as well as matters relating to telecommunications networks.	Yes	25(1)(a)
Australian Fisheries Management Authority (AFMA)	Environment	Responsible for the efficient management and sustainable use of Commonwealth fish resources. Activity is within a Commonwealth fishery area. AFMA expects petroleum operators to consult directly with fishing operators or via their fishing association body about all activities and projects which may affect day to day fishing activities.	Yes	25(1)(a)
Australian Hydrographic Office (AHO) – Department of Defence Operations Branch	Maritime	Manage the development, maintenance and disposal of the Defence estate, including unexploded ordnance. Department of Defence agency responsible for the publication and distribution of nautical charts and other information required for the safety of ships navigating in Australian waters. The AHO issues fortnightly Notices to Mariners for relevant nautical products.	Yes	25(1)(a)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Australian Maritime Safety Authority (AMSA)	Maritime	Responsible for maritime safety, adherence to advice, protocols, regulations. Issue radio-navigation warnings.	Yes	25(1)(a)
Clean Energy Regulator (CER)	Regulator	Responsible for implementing legislation to reduce carbon emissions and increase the use of clean energy.	Yes	25(1)(a)
Department of Agriculture and Fisheries NT (DAF)	NT Department	DAF supports industry development through globally competitive strategy, policy and promotion and delivers a regulatory framework that enables responsible growth, market access and stakeholder certainty.	Yes	25(1)(c)
Department of Biodiversity, Conservation and Attractions (DBCA)	WA Department	Western Australian government department responsible for managing lands and waters described in the *Conservation and Land Management Act 1984* (WA), the *Rottnest Island Authority Act 1987* (WA), the *Swan and Canning Rivers Management Act 2006* (WA), the *Botanic Gardens and Parks Authority Act 1998* (WA), and the *Zoological Parks Authority Act 2001* (WA), and implementing the state's conservation and environment legislation and regulations. The Department reports to the Minister for Environment and the Minister for Tourism.	Yes	25(1)(b)
Department of Climate Change, Energy, the Environment and Water (DCCEEW) including Underwater Cultural Heritage	Commonwealth Department	Responsible for preventing, responding to and recovering pests and diseases that threaten the economy and environment. Responsible for protecting Australia's ocean systems, threatened marine species and coastal blue carbon ecosystems.	Yes	25(1)(a)
Department of Energy and Economic Diversification (formerly Department	WA Department	Deliver initiatives on behalf of the WA Government that supports the full spectrum of economic activity in WA, including large-scale mining and industrial operations.	Yes	25(1)(b)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
of Jobs, Tourism, Science and Innovation (JTSI))				
Department of Foreign Affairs (DFAT)	National	Facilitates international relations with governments and other organisations. Specifically, DFAT will have functions relating to oil spills in international waters or foreign countries jurisdictions.	Yes	25(1)(a)
Department of Industry, Science, and Resources (DISR); including NOPTA	Commonwealth Department	Responsible for the OPGGSA. They are the policy maker for the offshore petroleum sector.	Yes	25(1)(a)
Department of Lands, Planning and Environment	NT Department	This department functions to foster and protect the environment and natural resources in the NT. This includes water, land resource management, environmental issues and the parks and wildlife functions. The Cobourg Peninsula is also managed as a national park (the Garig Gunak Barlu National Park) under a joint management arrangement between the Indigenous People and the Parks and Wildlife Commission of the Northern Territory.	Yes	25(1)(b)
Department of Local Government, Industry Regulation and Safety	WA Department	Its mission is to support a safe, fair and responsible future for the WA community, industry, energy and resources sector.	Yes	25(1)(c)
Department of Planning Lands and Heritage (DPLH); including Heritage Council of WA and	WA Department	Responsible for planning and managing all land use and heritage considerations within the state.	Yes	25(1)(b)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Aboriginal Cultural Heritage Committee				
Department of Primary Industries and Region Development (DPIRD) – Fisheries Division	WA Department	Department responsible for management of WA State fisheries – including licence holders, and maintenance of fisheries.	Yes	25(1)(b)
Department of Transport and Major Infrastructure (DTMI)	WA Department	Legislated responsibility for oil pollution response in State Waters.	Yes	25(1)(b)
Department of Water & Environmental Regulation (DWER)	WA Department	DWER is responsible for environment and water regulation, serving as a 'one stop shop' for industry and developers, with the aim of streamlining and simplifying regulation.	Yes	25(1)(b)
Director of National Parks (DNP)	Environment	The Director of National Parks is a corporation established under the EPBC Act, the principal Commonwealth legislation for establishing and managing protected areas. The corporation is constituted by the person appointed to the office named the Director of National Parks. Assessed as relevant for this EP, but DNP advised that no further consultation is required.	Yes	25(1)(a)
Environment Protection Authority (EPA)	WA Department	Primary environmental regulator for WA. They partner with business, government and the community to reduce pollution and waste, protect human health, and prevent degradation of the environment.	Yes	25(1)(b)
Federal Member for Kimberley – Melissa Price	WA Federal Member	Member for region that overlaps the Planning Area. Likely to be interested in constituent values and interests.	Yes	25(1)(b)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Indigenous Land and Sea Corporation (ILSC)	Statutory Body (First Nations)	An Australian federal government statutory authority with national responsibilities to assist Aboriginal and Torres Strait Islander people to acquire land and to manage assets to achieve cultural, social, environmental and economic benefits for Indigenous Peoples and future generations.	Yes	25(1)(a)
National Native Title Tribunal (NNTT)	Native Title	Commonwealth government authority responsible for administering the *Native Title Act 1993* (Cth) across multiple functions including reviews, mediations, and determinations for: Native Title applications, and ILUAs.	Yes	25(1)(a)
State Member for Kimberley – Divina Grace D'Anna	WA State Member	State Member for region very close to project area. Likely to have an interest in various aspects of the project.	Yes	25(1)(b)
Department of Agriculture, Fisheries and Forestry (DAFF) including Marine Pest Risk Management	Commonwealth Department	DAFF maintain and create agricultural export opportunities, to provide gains for Australian agriculture, fishing and forestry. They manage biosecurity risks to Australia to protect our multi-billion-dollar industries and our way of life. They engage with international counterparts to reinforce Australia's role in shaping how the global agriculture and fibre sector addresses food security, productivity, trade, sustainability and the impacts of climate change.	Yes	25(1)(a)
Commercial Fisheries				
Commonwealth Managed Fisheries				
Australian Northern Prawn Fishery	Commonwealth Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)
Christmas Island Fishery	Indian Ocean Territories	Commercial fishing activities and interests within the Planning Area - identified when the Planning Area was revised.	Yes	25(1)(d)
North West Slope Trawl Fishery	Commonwealth Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Southern Bluefin Tuna Fishery	Commonwealth Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)
Western Tuna and Billfish Fishery	Commonwealth Fishery	Concession holder with permission to fish in Commonwealth Fisheries that intersect the Planning Area.	Yes	25(1)(d)
WA Managed Fisheries				
Abalone Managed Fishery Licence	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)
Aquaculture Sites	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)
Australia Bay Seafoods	WA Commercial Fishery	Self-identified for previous EP.	Yes	25(1)(d)
Ardyaloon Trochus Hatchery and Aquaculture Centre	Indigenous Fisheries	The peak representative body for Indigenous aquaculture activities in the Kimberley. Lead organisation with Bardi Ardyaloon Hatchery. Has functions, interests and activities in the Planning Area.	Yes	25(1)(d)
North Coast Prawn Managed Fisheries	WA Commercial Fishery	This was formerly Broome Prawn, Kimberley Prawn and Onslow and Nickol Bay Prawn Managed Fisheries. Commercial fishing activities and interests within the Planning Area. Represented by WAFIC.	Yes	25(1)(d)
Cygnet Bay Pearl Farm	WA Commercial Fishery	Kimberley Pearl farm located on the periphery of the Planning Area.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Kimberley Crab Managed Fishery License	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area. Represented by WAFIC.	Yes	25(1)(d)
Kimberley Gillnet and Barramundi Managed Fishery	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area. Represented by WAFIC.	Yes	25(1)(d)
Mackerel Managed Fishery Licence	WA Commercial Fishery	Commercial fishing activities and interests in the Activity Area. Represented by WAFIC.	Yes	25(1)(d)
Marine Aquarium Fish Managed Fishery License	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area. Represented by WAFIC.	Yes	25(1)(d)
Northern Demersal Scalefish Managed Fishery License	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area. Represented by WAFIC.	Yes	25(1)(d)
Pearl Oyster Fishery	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)
Pilbara Crab Managed Fishery License	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)
Pilbara Fish Trawl Managed Fishery	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Pilbara Trap Managed Fishery	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)
South West Coast Salmon Fishery	WA Commercial Fishery	Advised by WAFIC that there is no fishing effort for this fishery.	No	
Specimen Shell Managed Fishery	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area. Represented by WAFIC.	Yes	25(1)(d)
The Western Australia Sea Cucumber Fishery	WA Commercial Fishery	Identified by DPIRD as relevant for this EP, as there is sea cucumber fishing within the Planning Area.	Yes	25(1)(d)
West Coast Deep Sea Crustacean Managed Fishery License	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area. Represented by WAFIC.	Yes	25(1)(d)
NT Managed Fisheries				
A1 – NT Coastal Line Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)
A2 – NT Coastal Net Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)
A4 – NT Spanish Mackerel Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
A5 – NT Offshore net and line Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)
A6 – NT Demersal Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)
A7 – NT Barramundi Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)
A8 – NT Mud Crab Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)
A10 – NT Pearl Oyster Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)
A12 – NT Aquarium Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)
A13 – NT Trepang Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)
A14 – NT Small Pelagic Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area. However, there are no fishing licenses for this fishery.	No	
A18 - NT Timor Reef Fishery	NT Commercial Fishery	Commercial fishing activities and interests in the Planning Area.	Yes	25(1)(d)
Fishery Associations, Committees and Councils				
Aquaculture Council of Western Australia (ACWA)	Industry Representative	Identified by DPIRD as relevant for this EP, as there are aquaculture sites within the Planning Area.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Industry Representative	Industry representative for commercial fishing of Bluefin Tuna in southern waters of Australia.	Yes	25(1)(d)
Commonwealth Fisheries Association	Industry Representative	Peak body representing the collective rights, responsibilities and interests of a diverse commercial fishing industry in Commonwealth regulated fishers. There are Commonwealth regulated fisheries in the Installation and Cold Commissioning Planning Area.	Yes	25(1)(d)
Northern Prawn Fishery Industry Pty Ltd	Commercial Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)
Northern Territory Guided Fishing Industry Association (NTGFIA)	Recreational Fishing	Identified in Tiwi Islands Sea Country Plan. The peak body responsible for promoting, developing, and maintaining the guided fishing industry in the Territory. Interests extend to both coastal rivers, estuaries and open waters of the Timor and Arafura Seas.	Yes	25(1)(d)
Seafood Industry Association	Industry Representative	Industry representative for Seafood Industry.	Yes	25(1)(d)
Small Pelagic Fishery Industry Association (SPFIA)	Industry Representative	Industry representative for small pelagic fishery. Requested not to be contacted	No	
South East Trawl Fishery Industry Association (SETFIA)	Industry Representative	Industry representative for South East Trawl fishery. Requested not to be contacted	No	
Southern Bluefin Tuna Management	Industry Representative	Industry representative for the Southern Bluefin Tuna Fishery.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Advisory Committee (SBTMAC)				
Tropical Tuna Management Advisory Committee	Industry Representative	Industry representative for Tropical Tuna Management.	Yes	25(1)(d)
TUNA Australia	Industry Representative	Represents statutory fishing right owners, holders, fish processors and sellers, and associate members of the Eastern and Western tuna and billfish fisheries of Australia.	Yes	25(1)(d)
WA Seafood Exporters	WA Commercial Fishery	Commercial fishing activities and interests within the Planning Area.	Yes	25(1)(d)
Western Australian Fishing Industry Council (WAFIC)	Industry Representative	Industry representative for WA Fishing Industry. The following fisheries were consulted via WAFIC: • Mackerel Fishery • Northern Demersal Scalefish Fishery • Marine Aquarium • Specimen Shell • West Coast Deep Sea Crustacean • Kimberley Crab Fishery	Yes	25(1)(d)
Western Rock Lobster Council	Industry Representative	Industry representative for Small Pelagic Fishery Industry.	Yes	25(1)(d)
Titleholders and Operators				
Carnarvon Energy Ltd	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
Deep C Store Pty Ltd	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Eni Australia Ltd	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
EOG Resources Australia	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
Finder Energy	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
INPEX	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
IPB Petroleum Limited	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
Jadestone Energy	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
Melbana Energy	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
MEO International	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
NT Gas Aust	Industry	Petroleum proponent holder within the Planning Area. No contact details were ascertainable for this organisation.	Yes	25(1)(d)
Pathfinder Energy	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
PTTEP Australasia (Ashmore Cartier)	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
Santos Ltd	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
Timor Gap	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
Timor Resources	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)
Woodside Energy Ltd	Industry	Petroleum proponent holder within the Planning Area.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Commercial Operators				
Absolute Ocean Charters	Tourism Operators	Commercial Boat Operator with activities (including whale watching) within the Planning Area.	Yes	25(1)(d)
Auriga Marine	Transport Operators	Transport Operator conducting operations in and over the ocean in the NT.	Yes	25(1)(d)
Aurora Expeditions	Tourism Operator	Operates activity-based cruises on the northern WA Coastline and is a member of Kimberley Marine Tourism Association (KMTA)	Yes	25(1)(d)
Coral Expeditions	Tourism Operator	Operates cruises on the Kimberley coast. Member of KMTA.	Yes	25(1)(d)
Eco Abrolhos	Tourism Operator	Cruise operator on the WA Kimberley coastline and Abrolhos Islands with marine based activities. Member of KMTA.	Yes	25(1)(d)
Fly Broome	Tourism Operator	Tourism Operator with activities in or adjacent to the Planning Area.	Yes	25(1)(d)
Kimberley Air Tours	Tourism Operator	Tourism Operator with activities in or adjacent to the Planning Area.	Yes	25(1)(d)
Kimberley Boat Cruises	Tourism Operator	Tourism Operator with activities in or adjacent to the Planning Area.	Yes	25(1)(d)
Kimberley Coastal Camp	Tourism Accommodation Provider	Accommodation provider located near the ocean. Likely to have interests and potentially activities in or adjacent to the Planning Area.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Kimberley Cruise Centre	Tourism Operator	Tourism Operator with activities in or adjacent to the Planning Area. Assessed as relevant but requested not to be contacted.	No	
Kimberley Ports Authority	Port Authority	Commercial operator with activities on and adjacent to the Planning Area.	Yes	25(1)(d)
Kimberley Quest – Beyond Adventure	Tourism Operator	Commercial cruise operators in the Kimberley.	Yes	25(1)(d)
Kuri Bay Sport Fishing Tours	Charter boat operator	Tourism Operator with activities in or adjacent to the Planning Area	Yes	25(1)(d)
Lady M Cruising	Tourism Operator	Cruise company operating in Kimberley. Member of KMTA	Yes	25(1)(d)
Odyssey Expeditions	Tourism Operator	Cruise boat located in the Kimberley's. Operates within the Planning Area, has social interests.	Yes	25(1)(d)
One Tide Charters	Tourism Operator	Kimberley cruise operator with activities in the marine environment	Yes	25(1)(d)
Oolin Sunday Island Cultural Tours	Tourism Operator	Indigenous Tourism Operator near the Planning Area	Yes	25(1)(d)
Reel Teaser	Charter boat operator	Tourism operator with activities in or adjacent to the Planning Area.	Yes	25(1)(d)
Slick Fishing Charters Broome	Charter boat operator	Commercial operator with activities in or adjacent to the Planning Area.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
The Great Escape Charter Company	Tourism Operator	Tourism Operator with activities in or adjacent to the Planning Area.	Yes	25(1)(d)
The Travelling Naturalist	Tourism Operator	Tourism Operator with activities in or adjacent to the Planning Area.	Yes	25(1)(d)
True North Kimberley Cruises	Tourism Operator	Tourism Operator with activities in or adjacent to the Planning Area.	Yes	25(1)(d)
Unreel Adventure Safaris	Tourism Operator	Tourism Operator with activities in or adjacent to the Planning Area.	Yes	25(1)(d)
Interest Groups				
10,000 Birds	Environment (Birding)	Likely to have interests in project activities that may impact the health, feeding, and breeding grounds of any migratory or seabirds within the Planning Area.	Yes	25(1)(e)
Amateur Fisherman's Association NT	Recreational Fishing	Peak Body for recreational fishing in the NT. Has a function representing recreational fishers who operate in the Planning Area.	Yes	25(1)(d)
Australasian Seabird Group	Environment	Established to promote seabird research and conservation in Australasia and the South Pacific.	Yes	25(1)(e)
Australasian Wader Studies Group (AWSG)	Environment	Organisation that has functions, activities, and interests in the Planning Area. Activities including monitoring shorebird populations, partnership with research institutions, formulate and promote policies for conservation of shorebirds and their habitat, promote wetland conservation and assist with nomination of sites for RAMSAR listing. Identified as relevant but AWSG requested to be removed from further consultation.	Yes	25(1)(d)
Australian Wildlife Conservancy	Environment	Not for profit focused on conservation of threatened wildlife and ecosystems in Australia.	Yes	25(1)(d)
Birding in Kimberley	Environment	Interest group engaging in birding activities.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Birdlife Top End	Environment	Central forum for community activities centred around the conservation of birds and their habitats. Conducts Migratory Shorebird Monitoring Program at several sites around Darwin. Monitors Key Biodiversity Areas.	Yes	25(1)(d)
BirdLife WA	Environment	Peak Body for Birdwatching in WA. Area covers WA as well as Cocos (Keeling) Islands, Christmas Island and Ashmore Reef. 6 regional groups. Carry out research projects with DBCA e.g. Australasian Bittern Recovery Team.	Yes	25(1)(e)
Broome Bird Observatory	Environment	Shorebird research in the East-Asian Australasian Flyway.	Yes	25(1)(d)
Broome Fishing Club	Recreational Fishing	Recreational fishing club with membership with interests in the marine environment.	Yes	25(1)(d)
Broome Surf Life Saving Club	Recreation	Water activities in Broome - close to Planning Area.	Yes	25(1)(d)
Diving WA Shipwrecks	Activity Based	Public group with a long history diving shipwrecks in WA and working in Tourism and Conservation. Their dive sites include Ashmore Reef and Browse Island within the Planning Area.	Yes	25(1)(d)
Kimberley Birdwatching	Environment	Birdwatching group with interest in animals who may be affected by Project activities.	Yes	25(1)(d)
King Bay Game Fishing Club	Environment	Fishing club with activities and interests in the Planning Area.	Yes	25(1)(d)
Maritime Archaeological Association of Western Australia	Environment	Interest Group focused on Maritime Archaeology.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
North Kimberley Land Conservation Committee	Environment	Environment interest group that intersects the Planning Area.	Yes	25(1)(d)
Recfishwest	Peak Body	Peak Body for Recreational Fishing in Western Australia.	Yes	25(1)(d)
Roebuck Bay Working Group Inc	Environment	Interest group with environmental focus in the Planning Area.	Yes	25(1)(d)
Non-Government Organisations				
AIATSIS (Australian Institute of Aboriginal and Torres Strait Islander Studies)	Research Institute	AIATSIS is an Indigenous-led, national institute that celebrates, educates, and inspires people from all walks of life to connect with the knowledge, heritage and cultures of Australia's First Peoples.	Yes	25(1)(d)
Australian Conservation Foundation	Environment	Recognised conservation organisation with interests in marine environment that likely extent into the Planning Area.	Yes	25(1)(d)
Australian Institute of Marine Science (AIMS)	Research Institute	AIMS is a Tropical Marine research institute that provides insights into Australia's tropical waters and knowledge to develop globally relevant and innovative research solutions. Shell work with AIMS on a number of research initiatives.	Yes	25(1)(d)
Australian Marine Conservation Society	Environment	The Australian Marine Conservation Society (AMCS) is a peak conservation body with strong interest in activities in the marine environment.	Yes	25(1)(d)
Australian Marine Oil Spill Centre (AMOSC)	Industry	AMOSC has an interest and a function in relation to the management of the oil industry's response to major oil spill. AMOSC's also play a role in training and coordinating industry personnel ready to provide immediate emergency oil spill response.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Ben and Jerry's	Environment	Activist with strong interest in climate change, supporting action against Sea Country petroleum and gas activities.	Yes	25(1)(d)
Conservation Council of WA	Environment	NGO in WA with an Environment focus.	Yes	25(1)(d)
Conservation Volunteers Australia	Environment	Conservation Volunteers is a non-profit organization that operates in Australia, New Zealand, and around the world. The organisation provides opportunities for volunteers to participate in conservation projects and initiatives, including habitat restoration, wildlife monitoring, and environmental education. Has social and environmental interests.	Yes	25(1)(d)
Environmental Defenders Office WA	Environment	The Environmental Defender's office of WA (EDOWA) is a not-for-profit and non-Government organisation that specialises in public interest environmental law.	Yes	25(1)(d)
Environs Kimberley	Environment	Environs Kimberley. Saving the nature of the Kimberley. Donate. As the peak environmental NGO for the Kimberley region in far north-west Australia, Environs Kimberley is dedicated to looking after the health of the land and waters of the region.	Yes	25(1)(d)
Greenpeace	Environment	Activist with strong interest in climate change, supporting action against Sea Country petroleum and gas activities.	Yes	25(1)(d)
High Seas Alliance	International	The High Seas Alliance is a partnership of organizations and groups aimed at building a strong common voice and constituency for the conservation of the high seas.	Yes	25(1)(d)
Martuwarra Fitzroy River Council	Environment	NGO in WA with an Environment focus.	Yes	25(1)(d)
Regional Development Australia Kimberley	Regional Development	Regional Development Australia (RDA) is an Australian Government initiative that brings together all levels of government to enhance the development of Australia's regions.	Yes	25(1)(d)
Save the Kimberley	Environment	NGO in WA with an Environment focus.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Sea Turtle.org	Environment	NGO in WA with an Environment focus.	Yes	25(1)(d)
Surfrider Foundation Australia	Environment	Dedicated to the protection and enjoyment of the world's ocean, waves, and beaches, for all people	Yes	25(1)(d)
United Nations	International	An international organisation where all the world's nations can gather together, discuss common problems, and find shared solutions that benefit all of humanity.	Yes	25(1)(d)
WA Marine Science Institute (WAMSI)	Environment	NGO with Environment protection focus that will have interest in the Planning Area and project activities.	Yes	25(1)(d)
WA Parks Foundation	Environment	NGO in WA with an Environment focus.	Yes	25(1)(d)
Wilderness Society	Environment	NGO in WA with an Environment focus.	Yes	25(1)(d)
WWF	Environment	NGO with Environment protection focus that will have interest in the Planning Area and project activities.	Yes	25(1)(d)
Academic and Research				
Australian National University	Academic Project	Research institution that has been identified as possibly engaging in research located within the Planning Area, therefore having interests.	Yes	25(1)(d)
Deep History of Sea Country Research Project	Academic Project	The Deep History of Sea Country Research Project is a collaborative research initiative that aims to document and preserve the cultural and environmental heritage Indigenous Sea Countries in northern Australia. The project involves a range of Indigenous and non-Indigenous researchers, community members, and relevant persons, and focuses on using traditional knowledge, scientific research, and technological innovation to better understand and protect Australia's marine environments.	Yes	25(1)(d)
Fisheries Research and Development Corporation (FRDC)	Fisheries	Statutory corporation that manages research and development investment by the Australian Government and the Australian fishing and aquaculture commercial, recreational, and Indigenous sectors.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Kimberley Marine Research Station	Research Institute.	Operational marine science hub for independent research on the coastal and marine environments of the Kimberley. Research activities and interests in marine environment	Yes	25(1)(d)
The Ecology Centre (UQ)	Environment	Potential interest in the Planning Area through research activities.	Yes	25(1)(d)
Industry Representative Bodies				
Australian Energy Producers (AEP)	Industry Representative	AEP is the peak national body representing Australia's upstream oil and gas sector. AEP are considered interested, rather than relevant.	No	N/A
Kimberley Marine Tourism Association	Peak Body	Tourism Peak Body with membership base across Kimberley. Members may have activities in the Planning Area.	Yes	25(1)(d)
Western Australian Game Fishing Association (WAGFA)	Game Fishing	Industry representative for Small Pelagic Fishery Industry.	Yes	25(1)(d)
Service Providers				
Broome Sea Rescue	Volunteer & Emergency Services	Emergency services located in Broome. Operates within the Planning Area and has social interests.	Yes	25(1)(d)
Broome Volunteers Fire & Sea Rescue Service	Volunteer & Emergency Services	Emergency services located in Broome. Operates within the Planning Area, has social interests. Would become involved in the case of an incident on Prelude.	Yes	25(1)(d)
NT Emergency Service Darwin – Volunteer Unit	Volunteer & Emergency Services	Emergency services located in Darwin. Operates within the Planning Area, has social interests. Would become involved in the case of an incident on Prelude.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Territory Emergency Management Council (TEMC)	Emergency Services	Further to consultation with TEMC, they have advised that the remote location of this operation is outside of the NTFES's ability to respond to an emergency in a timely manner.	No	N/A
International RPs				
Embassy of the Republic of Indonesia	Government Organisation	Referred to by DFAT given the Planning Area extends into Indonesian Waters. Indonesia maintains a significant diplomatic presence in Australia, with its embassy located in Canberra.	Yes	25(1)(d)

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
Indigenous Organisations and People					
Kimberley Land Council	Land Council	KLC is the peak Indigenous body in the Kimberley region working with Indigenous People to secure Native Title, conduct conservation and land management activities and develop cultural business enterprises. KLC is an NTRB. KLC is the contact point for the following specific RNTBCs, and Indigenous organisations identified as relevant to this EP: • Balanggarra Aboriginal Corporation • Gogolanyngor Aboriginal Corporation	Yes	25(1)(d)	1

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
		• Nyangumarta Karajarri Aboriginal Corporation • Kimberley Ranger Network • Indigenous Saltwater Advisory Group (ISWAG) • Madanaa nada Aboriginal Corporation • Nimanburr Aboriginal Corporation • Nyul Nyul PBC Aboriginal Corporation Wanjina Wunggurr (Native Title) Aboriginal Corporation including Wunambal Gaambera Aboriginal Corporation, Dambimangari Aboriginal Corporation and Willinggin Aboriginal Corporation			
Northern Land Council (NLC)	Land Council	Northern Land Council is the peak Indigenous body in the northern part of the Northern Territory working with Indigenous People to secure Native Title, conduct conservation and land management activities and develop cultural business enterprises. NLC is a NTRB. NLC is the contact point for the following specific RNTBCs, and Indigenous organisations identified as relevant to this EP: • Arnhem Land Aboriginal Land Trust • Bulgul Land and Sea (Management) Rangers • Croker Island • Dak Djerat Guwe People • Delissaville / Wagait / Larrakia Aboriginal Land Trust • Garngi Land and Sea Management / Garngi Community Rangers • Legune Pastoral Lease • Malak Malak Land and Water Management Rangers	Yes	25(1)(d)	1

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
		• Mardbalk Land and Sea Management / Warruwi Community Mardbalk Marine Rangers • Top End Aboriginal Corporation RNTBC • Kenbi Rangers • Cobourg Peninsula Sanctuary Land Trust			
Bardi and Jawi Niimidiman Aboriginal Corporation	RNTBC / Native Title Determination	Statutory function, interests and activities due to role as RNTBC/ PBC for Bardi and Jawi people. Represent Native Title holders.	Yes	25(1)(d)	2
Bidyadanga Aboriginal Community La Grange Inc.	Aboriginal Corporation	Local Aboriginal Corporation for remote community. Activities and interests within the Planning Area.	Yes	25(1)(d)	2
Dak Djerat Guwe People	Native Title Claim	Native Title claimants. This group has been identified as potentially having separate and unique functions, interests, and activities in their land and/or Sea Country. Only contacted via NLC.	Yes	25(1)(d)	2
Dambimangari Aboriginal Corporation	RNTBC	Statutory functions, interests, and activities due to role as RNTBC/ PBC. Represent Native Title holders. Wunambal Gaambera, Dambimangari and Willinggin people make up the Wanjina Wunggurr Community and Wanjina Wunggurr (Native Title) Aboriginal Corporation, with each group managing its own Country identified through Native Title determination through separate Aboriginal Corporations	Yes	25(1)(d)	2
Djarindjin Aboriginal Corporation (DAC)	Aboriginal Corporation	Djarindjin Aboriginal Corporation (DAC) through entity Djarindjin Airport Pty Ltd (DAPL) operate airport for Prelude.	Yes	25(1)(d)	2

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
Gogolanyngor Aboriginal Corporation	RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders. KLC confirmed they are the correct contact point.	Yes	25(1)(d)	2
Goolarabooloo Millibinyarri Indigenous Corporation	Aboriginal Corporation	GMIC represents the traditional law and culture families of the Goolarabooloo people.	Yes	25(1)(d)	2
Joombarn-Buru Aboriginal Corporation RNTBC	Aboriginal Corporation	Self-identified through previous EPs. Statutory function, interests and activities due to role as RNTBC/ PBC.	Yes	25(1)(d)	2
Kalumburu Aboriginal Corporation	Aboriginal Corporation	Local Aboriginal Corporation for remote community situated on the coast. Falls within the Planning Area.	Yes	25(1)(d)	2
Karajarri Traditional Lands Association (KTLA) Aboriginal Corporation	Native Title Holders/ RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders. The Karajarri community has a Native Title determination across shared country for two different tribal groups who share traditional laws and cultural connection to the area. Nyangumarta Karajarri Aboriginal Corporation refers to a shared portion of land between Karajarri and Nyangumarta Warran determinations.	Yes	25(1)(d)	2
Nyangumarta Karajarri Aboriginal Corporation	Native Title Holders/ RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders. The Karajarri community has a Native Title determination across shared country for two different tribal groups who share traditional laws and cultural connection to the area. Nyangumarta Karajarri Aboriginal Corporation refers to a shared portion of land between Karajarri and	Yes	25(1)(d)	2

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
		Nyangumarta Warran determinations. Originally Shell contacted this organisation via KTLA but as consultation progressed, it was established that KLC are the contact point for Nyangumarta Karajarri.			
Kimberley Indigenous Saltwater Advisory Group (ISWAG)	Advisory Group	ISWAG is a collective of Saltwater Kimberley Traditional Owner groups, recognising the enduring connection between Traditional Owners and their Sea Country. Interest in Sea Country. Consulted through the Kimberley Ranger Network, ISWAG is supported by KLC and Nyamba Buru Yawuru. For the purposes of documenting consultation, ISWAG and KRN have been grouped together as they have the same contact for both.	Yes	25(1)(d)	2
Kimberley Ranger Network (KRN)	Land and sea Management	Indigenous Rangers have functions, interests, and activities, to maintain the health of Country and Sea – linked to Native Title Determinations, IPA agreements or Federal/ State funding. For the purposes of documenting consultation, ISWAG and KRN have been grouped together as they have the same contact for both.	Yes	25(1)(d)	2
Kullari Regional Communities Incorporated (KRCI)	Community Development	Indigenous not for profit organisation predominantly funded by the Federal Government. A mission to provide Aboriginal people with assistance, programs, and activities to enhance individual skills, community self-management, economic development and a pathway to accredited training and employment.	Yes	25(1)(d)	2

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
Larrakia Development Corporation	Aboriginal Corporation	A commercial Aboriginal organisation that provides employment and business opportunities for Larrakia people through its own wealth creation and entrepreneurial activities.	Yes	25(1)(d)	2
Larrakia Nation Aboriginal Corporation	Aboriginal Corporation	Larrakia Nation is the peak body for Larrakia people.	Yes	25(1)(d)	2
Lombadina Aboriginal Corporation incl. Accommodation and Tours	Aboriginal Corporation	Tourism and commercial activities/ interests.	Yes	25(1)(d)	2
Mayala Inninalang Aboriginal Corporation (incl Mayala 2)	RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders.	Yes	25(1)(d)	2
Miriuwung-Gajerrong	Aboriginal Corporation	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders.	Yes	25(1)(d)	2
Munupi Aboriginal Corporation	Aboriginal Corporation	Registered charity/not for profit with links to the Munupi Aboriginal Arts and Craft Association.	Yes	25(1)(d)	2
Nimanburr Aboriginal Corporation	RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders.	Yes	25(1)(d)	2
Yawuru Native Title Holders Aboriginal Corporation RNTBC	RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders.	Yes	25(1)(d)	2
Nyul Nyul PBC Corporation	RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders. This	Yes	25(1)(d)	2

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
		group was identified by the KLC to Shell, including that the KLC is the correct contact point			
Thamurrur Development Corporation (TDC) including Thamurrur Rangers	Aboriginal Corporation	Thamarrurr Development Corporation Ltd (TDC) is a not-for-profit corporate entity owned by members of the four main ceremonial groups – the Wangga, Lirrga, Wulthirri and Tharnpa peoples – and established by the 20 clans of the Thamarrurr region. TDC represents the interests of these clan groups.	Yes	25(1)(d)	2
Tiwi Land Council (TLC) Incl. Tiwi Marine Rangers	Aboriginal Land Trust/ Land Council	Council statutory function, interests and activities due to role as Land Council. Represents Tiwi people in the protection of land, sea and environment. The TLC is responsible to ensure that activities on the Tiwi Islands are undertaken only after consultation with the relevant Tiwi Clan group. The TLC is made up of four members from each of the Clan groups of the Tiwi Islands. There are 8 landowning groups on the Tiwi Islands: • Jikilaruwu (Bathurst Island) • Malawu (Bathurst Island) • Mantiyupwi (Bathurst and Melville Island) • Marrikawuyanga (Melville Island) • Munupi (Melville Island) • Wulirankuwu (Melville Island) • Wurankuwu (Bathurst Island) • Yimpinari (Melville Island)	Yes	25(1)(d)	2

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
Top End Aboriginal Coastal Alliance (TEACA)	Consultative Committee	TEACA has been working to ensure that the offshore resources industry is properly consulting with First Nations persons and communities in coastal areas of the top end of the NT. TEACA represent 13 First Nations Consultative Committees. The following have been assessed as relevant for this EP due to their proximity to the Planning Area: • Cobourg First Nations Consultative Committee • Djulidki First Nations Consultative Committee • Gapu Maringa First Nations Consultative Committee • Goulburn Islands First Nations Consultative Committee • Jindiwi First Nations Consultative Committee • Kardu Lalingkin First Nations Consultative Committee • Maningrida Regional First Nations Consultative Committee • Mulurryud First Nations Consultative Committee • Ngoy Garmak First Nations Consultative Committee • Rak Badjalarr First Nations Consultative Committee • Tiwi Clans First Nations Consultative Committee	Yes	25(1)(d)	2
Walalakoo Aboriginal Corporation including the Nyikina Mangala Rangers	RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders	Yes	25(1)(d)	2

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
Wanjina-Wunggurr (Native Title) Aboriginal Corporation	RNTBC	Statutory functions, interests, and activities due to role as RNTBC/ PBC. Represent Native Title holders. KLC confirmed they are the correct contact point. Wunambal Gaambera, Dambimangari and Willinggin people make up the Wanjina Wunggurr Community, with each group managing its own Country under separate Aboriginal Corporations.	Yes	25(1)(d)	2
Wilinggin Aboriginal Corporation	Aboriginal Corporation	Wilinggin Aboriginal Corporation is the agent of Wanjina-Wunggurr Aboriginal Corporation in relation to the interests of the Ngarinyin people and activities on Country, which includes, but is not limited to, management of Indigenous Protected Area (IPA) as well as fire and carbon projects within the Wilinggin Native Title determination. Wunambal Gaambera, Dambimangari and Willinggin people make up the Wanjina Wunggurr Community and Wanjina Wunggurr (Native Title) Aboriginal Corporation, with each group managing its own Country identified through Native Title determination through separate Aboriginal Corporations.	Yes	25(1)(d)	2
Wunambal Gaambera Aboriginal Corporation (including the Uunguu Rangers)	Aboriginal Corporation	Conduct land business and interest transactions of the Wunambal Gaambera people, who hold Native Title over land and seas (Wanjina Wunggurr (Uunguu) NT determination. Wunambal Gaambera, Dambimangari and Willinggin people make up the Wanjina Wunggurr Community and Wanjina Wunggurr (Native Title) Aboriginal Corporation, with each group managing its own Country identified through Native Title determination through separate Aboriginal Corporations.	Yes	25(1)(d)	2

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
Anindilyakwa Land Council	Aboriginal Land Council	Swordfish interest.	Yes	25(1)(d)	3
Ardi'ol Art & Culture	First Nations Group	Saltwater people and clan group of the Bardi tribe with interests in Ardyaloon (One Arm Point) and activities and interests in the Development Drilling Planning Area.	Yes	25(1)(d)	3
Balanggarra Rangers	Land and Sea Management	Indigenous Rangers have functions, interests, and activities, to maintain the health of country and sea – linked to Native Title Determinations, IPA agreements or Federal/ State funding. Consulted through the Kimberley Ranger Network.	Yes	25(1)(d)	3
Cheeditha Art Group	Tourism Operator	Indigenous Tourism Operator near the Planning Area.	Yes	25(1)(d)	3
Crocodile Islands Rangers / Maringa Ocean Patrol	Land and Sea management	Indigenous Rangers have functions, interests, and activities, to maintain the health of country and sea - linked to Native Title Determinations, IPA agreements or Federal/ State funding.	Yes	25(1)(d)	3
Dhimurru Aboriginal Corporation	Aboriginal Corporation	Manage natural and cultural resources of Yolngu people - seafloor and habitat mapping, as well as surveys of fish and benthic communities.	Yes	25(1)(d)	3
Djarindjin Campgrounds	Accommodation/ Tourism Operator	Indigenous Tourism Operator near the Planning Area.	Yes	25(1)(d)	3
Gumurr Marthakal Rangers	Land and Sea management	Indigenous Rangers have functions, interests and activities, to maintain the health of country and sea - linked to Native Title Determinations, IPA agreements or Federal/ State funding. In the process of declaring an	Yes	25(1)(d)	3

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
		Indigenous Protected Area and related management plan.			
Kariyarra Aboriginal Corporation	RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders.	Yes	25(1)(d)	3
Kimberley Aboriginal Law and Cultural Centre (KALACC)	Cultural Centre	Law and cultural business. Activities, interests	Yes	25(1)(d)	3
Kimberley Cultural Adventures	Indigenous Tourism Operator	Indigenous Tourism Operator near the Planning Area.	Yes	25(1)(d)	3
Kimberley Jiyigas	Interest Group	Collective of Kimberley Indigenous women that provides a platform for facilitating the united collective voice.	Yes	25(1)(d)	3
Kimberley Ranger Network	Land and Sea Management	Indigenous Rangers have functions, interests, and activities, to maintain the health of country and sea – linked to Native Title Determinations, IPA agreements or Federal/ State funding. The Kimberley Ranger Network is facilitated by KLC and comprises of 18 Ranger Groups. The following are relevant for this EP: • Balanggarra Rangers • Bardi Jawi Oorany Rangers • Bardi Jawi Rangers • Kimberley Indigenous Saltwater Advisory Group (ISWAG) • Nyikina Rangers • Nyul Nyul Rangers	Yes	25(1)(d)	3

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
		For the purposes of documenting consultation, iSWAG and KRN have been grouped together as they are the same contact for both.			
KRED (Ambooriny Burru Charitable organisation)	Aboriginal Corporation	Social and economic development across the Kimberley. Functions, activities, interests	Yes	25(1)(d)	3
Mabu Buru Tours	Tourism Operator	Indigenous Tourism Operator near the Planning Area	Yes	25(1)(d)	3
Madanaa Nada Aboriginal Corporation RNTBC	RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders.	Yes	25(1)(d)	3
Mercedes Cove Exclusive Coastal Retreat	Tourism Accommodation Provider	Indigenous Tourism Operator near the Planning Area.	Yes	25(1)(d)	3
Mowanjum Aboriginal Art & Culture Centre	Art Gallery	Aboriginal art gallery and representative for Derby artists.	Yes	25(1)(d)	3
Mowanjum Aboriginal Corporation	Aboriginal Corporation	Function, interests and activities due to role as administering entity for the Mowanjum Community.	Yes	25(1)(d)	3
Murujuga Aboriginal Corporation including the land and sea unit	Aboriginal Corporation	Function, interests and activities due to role as administering entity for Burryp and Mailand Industrial Estates. Representing the Ngarluma, Mardudhunera, Yaburara, Yindjibarndi, and Wong-Goo-Tt-Oo peoples.	Yes	25(1)(d)	3
Nagula Jarndu Women's Arts and Resource Centre	Art Gallery	Commercial Operator with activities in or adjacent to the Planning Area.	Yes	25(1)(d)	3

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
Narlijia Experiences Broome	Tourism Operator	Indigenous Tourism Operator near the Planning Area	Yes	25(1)(d)	3
Northern Australian Indigenous Land and Sea Management Alliance	Land and Sea Management	Indigenous led not-for-profit assisting Indigenous People manage their country.	Yes	25(1)(d)	3
NT Indigenous Business Network	Business Operator	The peak body representing Indigenous businesses in the Territory.	Yes	25(1)(d)	3
Nyangumarta Warrarn Aboriginal Corporation	Native Title Determination	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders.	Yes	25(1)(d)	3
Pudakul Aboriginal Cultural Tours	Tourism Operator	Tourism operator with activities in or adjacent to the Planning Area. Cumulative interests due to being Indigenous operated.	Yes	25(1)(d)	3
Saltwater Cultural Tours	Business Operator	Activities due to marine business out of Darwin.	Yes	25(1)(d)	3
Specialised Indigenous Services	Individual	Descendant and Elder of the Bardi Jawi and Karajarri from the West Kimberley. Has strong cultural interest in traditional land and Sea Country.	Yes	25(1)(d)	3
Tarntipi Bushcamp	Indigenous Business	Eco resort - activities/ interests.	Yes	25(1)(d)	3
Tiwi Resources Pty Ltd	Aboriginal Corporation	Purpose is to gain economic opportunities for the Tiwi People.	Yes	25(1)(d)	3
WAITOC	Tourism Operator	Indigenous Tourism Operator near the Planning Area.	Yes	25(1)(d)	3

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category	Tier
Wangaba Roebourne	Tourism Operator	Indigenous Tourism Operator. Not located near enough to the Planning Area.	No		
Wanparta Aboriginal Corporation	RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders.	Yes	25(1)(d)	3
Wirrawandi Aboriginal Corporation	RNTBC	Statutory function, interests and activities due to role as RNTBC/ PBC. Represent Native Title holders.	Yes	25(1)(d)	3
Yagbani Aboriginal Corporation	Aboriginal Corporation	Training, employment, and support to the Aboriginal people of Warruwi.	Yes	25(1)(d)	3
Yamatji Marlpa Aboriginal Corporation (YMAC)	Aboriginal Corporation	Yamatji Marlpa Aboriginal Corporation (YMAC) is the Native Title representative body for the Pilbara, Midwest, Murchison, and Gascoyne regions of Western Australia.	No		

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Online enquiry				
Person 1	Individual	Indicated an interest in Northern Kimberley region (Kalumburu and surrounding islands). Individual was provided with sufficient information as well as dates for community sessions. Assessed as not relevant for this EP as no functions, interests or activities identified.	No	
Person 2	Individual	Indicated an interest in Broome. Individual was provided with sufficient information as well as dates for community sessions. Assessed as not relevant for this EP as no functions, interests or activities identified.	No	

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Person 3	Individual	Indicated an interest in employment opportunities. Individual was provided with sufficient information. Assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Person 4	Individual	Indicated an interest in employment opportunities. Individual was provided with sufficient information. Assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Person 5	Individual	Indicated an interest in employment opportunities. Individual was provided with sufficient information. Assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Person 6	Individual	Indicated an interest in commissioning. Individual was provided with sufficient information. Assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Person 7	Individual	Indicated an interest in modifications for Prelude. Individual was provided with sufficient information. Assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Person 8	Individual	Indicated an interest in employment opportunities. Individual was provided with sufficient information. Assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Person 9	Individual	Indicated an interest in Government Marine Park Management. Individual was provided with sufficient information. Assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Person 10	Individual	Indicated an interest in Environmental Protection. Individual was provided with sufficient information. Assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Person 11	Individual	Indicated an interest in the project timeline. Individual was provided with sufficient information. Assessed as not relevant for this EP as no functions, interests or activities were identified.	No	

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Person 12	Individual	Anti oil and gas sentiment. Not relevant.	No	
Person 13	Individual	Foreign language email. Not relevant.	No	
Person 14	Individual	Indicated an interest in marine turtles and other sea life. Individual was provided with sufficient information. Assessed as not relevant for this EP as no functions, interests or activities were identified.	No	

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Attended a community information or drop-in session				
Ngnowar Aerwah Aboriginal Corporation	Aboriginal Corporation	Shell used their meeting room facilities for the drop-in session at Wyndham and met them there. Mutually agreed they are not relevant to this EP.	No	
Shire of Derby	Local Council	Attended the Derby drop-in session. Provided feedback on better ways to promote these sessions locally and had a general interest in Prelude. Once sufficient information was provided, this individual was assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Mental Health Social Worker	Local Government	Attended the Derby drop-in session. Popped in to drop off a business card. Once sufficient information was provided, this individual was assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Marnin Bowa Dumbara Aboriginal Corporation	Aboriginal Corporation	Attended the Derby drop-in session, with a general interest in Prelude. Once sufficient information was provided, this individual was assessed as not relevant for this EP as no functions, interests or activities were identified.	No	

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Broome International Airport	Airport	Attended the Broome community information session with a general interest in Prelude. Once sufficient information was provided, this individual was assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Broome Circle	Local community	Attended the Broome community information session with an interest in employment and local content. Once sufficient information was provided, this individual was assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Department of Transport and Major Infrastructure Broome	Government	Attended the Broome community information session with an interest in Indigenous engagement. Feedback received on taking into account smaller groups of Indigenous relevant persons in the region. Department of Transport and Major Infrastructure identified as a relevant person.	Yes	Refer to 16 Department of Transport and Major Infrastructure.
Kimberly Ports Authority	Peak Body	Attended the Broome community information session. Kimberley Marine Tourism Association listed as a relevant person.	Yes	Refer to 440. Kimberley Marine Tourism Association.
North Regional TAFE	Academic	Attended the Broome community information session with a general interest in Prelude. Once sufficient information was provided, this individual was assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Pilbara Kimberley University Centres	Academic	Attended the Broome community information session with a general interest in Prelude. Once sufficient information was provided, this individual was assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Djarindjin Aboriginal Corporation	Aboriginal Corporation	Attended the Broome community information session. DAC listed as a relevant person.	Yes	Refer to 32. Djarindjin Aboriginal Corporation.

Individual or Organisation	Group	Rationale	Relevant for this EP	Link to Section 25 of the OPGGS(E) Regulations Category
Broome Scrap Metal	Local business	Attended the Broome drop-in session with a general interest in Prelude. Once sufficient information was provided, they were assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Dice	Local business	Attended the Darwin community information session with a general interest in Prelude. Once sufficient information was provided, they were assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Gibson Civil Contracting	Local business	Attended the Darwin community information session with a general interest in Prelude. Once sufficient information was provided, they were assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
Santos	Industry	Attended the Darwin community information session. Santos is listed as a relevant person.	Yes	Refer to 189. Santos.
INPEX	Industry	Attended the Darwin community information session. INPEX is listed as a relevant person.	Yes	Refer to 191. INPEX.
Quality People	Local business	Attended the Darwin community information session with a general interest in Prelude. Once sufficient information was provided, they were assessed as not relevant for this EP as no functions, interests or activities were identified.	No	
NTIBN	Business Operator	Attended the Darwin community information session. NTIBN is listed as a relevant person.	Yes	Refer to 132. NTIBN.

5.8 Consultation Approach

5.8.1 Providing Sufficient Information

Section 25(2) of the OPGGS(E) Regulations requires titleholders to provide relevant persons with sufficient information to allow relevant persons to make an informed assessment of the possible consequences of the proposed activities on their functions, interests, or activities.

Shell has demonstrated compliance with this requirement as follows:

- Information provided was appropriately detailed to allow relevant persons to make assess how their functions, interests or activities may be affected (Section 5.8.2).
- Information was tailored to the specific functions, interests, and activities of relevant persons based on the information Shell had available at the time (Section 5.8.3).
- Additional information was provided upon request, where it was considered reasonable or related to EP content or supporting information (Section 5.8.4).
- Shell raised awareness of NOPSEMA's Guideline: Consultation in the course of preparing an environment plan for relevant persons (N-04750-GL2086) (Section 5.8.5).
- Shell published the draft EP on its website on 24 September 2025 (Section 5.8.6).

5.8.2 Information given allowed informed decisions by relevant persons

The initial call out for relevant persons and the iterations of information provided throughout the consultation process were designed to ensure that a relevant person could make an informed decision as to how the proposed activities could affect their functions interest and activities. This included the advertising campaign, that promoted Shell's website with relevant EP information. This enabled any interested party to seek further details and assess the implications of the proposed activities (see Section 5.8.3).

5.8.3 Tailored information to the relevant persons functions, interests, and activities

In determining information requirements, Shell considered the functions, interests and activities of the relevant persons and the nature and scale of environmental impacts and risks that could affect them. Shell recognised that different categories of relevant persons required different levels of engagement and adopted a targeted approach to communication. This splits relevant persons into three key groups:

1. Broad community
2. Indigenous
3. Commercial Fishers

Further, Shell adheres to published guidance for good practice consultation relevant to different sectors and disciplines, as described below.

Materials were developed in collaboration with subject matter experts, including corporate communications professionals, to ensure content was clear, relevant and appropriate for each audience. Instead of a 'one size fits all' approach, a suite of materials were developed to support the various communications: channels listed in Table 5-9 and Appendix A summarises the communication channels used for each relevant persons during the development of this EP.

The methodology used by Shell to provide relevant persons with sufficient information is outlined below and the evidence of the information provided can be found in Appendix B.

5.8.4 Provided further information for relevant persons on request

Shell developed targeted consultation material appropriate to the category of relevant persons, such as specific information sheets or presentation materials. These were prepared either proactively by Shell or in response to requests from relevant persons. For example, commercial fishing licence holders and representative bodies received additional information specific to their fishery, while bespoke information was developed for Indigenous People, as appropriate (see Appendix B).

To ensure information was appropriately provided to relevant persons, Shell invited feedback, sought advice, provided information and facilitated access via community drop-in sessions. Feedback on the clarity, relevance

and usefulness of the materials was adopted from relevant persons throughout the consultation period and the information provided was refined and improved because of that feedback.

5.8.5 Raise awareness of NOPSEMA's guideline for relevant persons

NOPSEMA released its updated Guideline: Consultation in the course of preparing an environment plan (N-04750-GL2086) on 20 May 2024. The Guideline encourages titleholders to provide relevant persons with a copy of the NOPSEMA Consultation on offshore environment plans Brochure as part of consultation. This Brochure is posted on Shell's public website and was included in the initial consultation emails to relevant persons in December 2024 (see Appendix B.).

5.8.6 Publication of the draft EP

To support transparency and accessibility, Shell published the draft EP on its website on 24 September 2025 and shared the link via the third and final email campaign. This allowed relevant persons to access the full draft at their convenience.

The online publication ensured that information was available to a broad audience and supported Shell's commitment to open and inclusive consultation.

5.8.7 Providing a reasonable period for consultation

Section 25(3) of the OPGGS(E) Regulations provides that titleholders must give relevant persons a reasonable period for consultation. Shell allows a minimum of 30 days from the date sufficient information is provided allowing relevant persons time to review and respond to potential impacts on their functions, interests, or activities.

In cases, where no response is received within a 30-day period, Shell issues a follow-up communication. Shell recognises that additional time may be required for relevant persons to provide feedback due to availability and accessibility issues. Shell assesses requests for additional time on a case by-case basis.

For communal interests, such as those held by Indigenous People, Shell acknowledges that extended consultation periods are more appropriate. Where this occurred, it has been documented in Table 5-11 and Table 5-12.

Shell understands that participating in consultation is voluntary and that limitations may arise e.g. when contact details are unavailable.

If feedback is received after submission of the final EP to NOPSEMA, it cannot be incorporated in the approved control measures. However, Shell will consider such feedback as part of the EP's implementation Strategy (refer Section 10).

Where late feedback identifies a significant measure or control that requires implementation or update to meet the intended outcome of consultation, Shell will apply its Management of Change (MOC) and Review process (in accordance with the obligations under sections 19, 26, 38 and 39 of the OPGGS(E) Regulations).

Table 5-9: Consultation Channels

Channel	Purpose
Consultation emails	Shell sent out three batch email campaigns over 2024-2025, tailored to three relevant persons categories; Broad community, Indigenous and Commercial Fisheries. Each email included: • information about the EP information, including • contact details with various • options to obtain more information, ask questions or provide feedback • details on the Titleholders obligation to undertake consultation and the role of relevant persons • an invitation to provide input on preferred consultation method. For a large portion of Commercial Fishers, where only postal addresses are available, letters were used instead of emails. In this case, only one letter was sent.

Channel	Purpose
Information Sheets	Short, sharp, digestible documents that outline the key facts related to this EP including: • description of the environment. • summary of the environmental impacts and risks. • summary of the risk mitigation and management control measures. Distributed directly as part of the email campaign and available on Shell's website. Not intended as the sole communication method.
Information Sessions	Targeted information sessions held in Broome and Darwin to relevant persons, largely from the business community. A formal presentation on the EP was delivered with time for questions. Designed for similar relevant persons to engage collectively.

Drop-in Sessions	Flexible and informal sessions were held to facility two-way dialogue and share information about this EP. These sessions took place in accessible locations within relevant communities and were attended by Subject Matter Experts from appropriate Shell disciplines to provide detailed insights and answer questions.
	To ensure broad awareness and participation, the sessions were widely promoted through targeted public advertisements. Additionally, information was shared with local governments, business chambers and community organisations to further disseminate details and encourage community engagement.
	Locations were selected based on the following criteria:
	• Presence of a community located within or immediately adjacent to the coastal boundary of the Planning Area.
	• In areas with multiple small communities in close proximity, the most populated community was chosen as the representative location.
	• Community sessions for this EP were held in:
	  ○ Darwin
	  ○ Derby
	  ○ Broome
	  ○ Djarindjin
	  ○ Wyndham
	  ○ Kununurra.

Tailored face to face / Microsoft Teams' meetings	One on one small group meetings arranged as needed. Enabled in-depth discussions, questions and feedback tailored to specific interests.
Online materials and information	The website provided more information than an Information Sheet and including a form allowing relevant persons to self-identity.
Sharing the entire draft EP via Shell's website	Full draft EP published online for transparency and access to detailed technical information.
Advertising campaign	Adverts were placed across regional print, broadcast and social media to raise awareness of the EP consultation period and allow self-identification. Adverts also promoted local drop-in sessions.
Industry support	Information shared via membership and industry groups.
Fee for service consultation	Shell engaged in a fee for service model with WAFIC and Tuna Australia who engaged their members on Shell's behalf.

Channel	Purpose
Traditional communications	Included email, telephone, postal mail for direct outreach.
Maps	Visual aids that showed; • activity locations • exclusion zones • fisheries and community areas of interest.
Prelude animation	A visual explanation of Prelude activities in an accessible format.
NOPSEMA's consultation brochure	Explained regulatory requirements, titleholder obligations and relevant person roles.
Power point presentations	Customised presentations based on feedback and specific areas of interest.

5.8.8 Broad community

This category includes groups identified in the relevant person search such as, Commercial Operators, Interest Groups, NGOs, Community Groups, academic research or persons, as well as Titleholders and operators and Commonwealth and State Government.

Consultation was conducted through a combination of methods including:

- Targeted emails containing information sheets and links to the Prelude website
- Community drop-in sessions
- Targeted community information sessions and
- A media campaign.

This multi-channel approach was considered suitable to consult with this group given the low nature and scale of potential affects to a relevant person's functions, interests, or activities.

5.8.9 Commercial Fisheries

Consultation with commercial fisheries (both active and potentially active) involved the following:

- Government authorities – including AFMA, DCCEEW, DPIRD, and DAF-NT, were engaged regarding the proposed activity and engagement with relevant persons from commercial fisheries groups.
- Fishing industry associations representing fisheries with licence areas that overlap the Planning Area, such as WAFIC and Commonwealth Fisheries Association, were consulted regarding the proposed activity and engagement with their members.
- WAFIC and Tuna Australia were engaged on a fee-for-service basis to consult with their members regarding the proposed activities and this EP.
- Shell consulted directly with licence holders to provide additional assurance that all relevant persons received sufficient information to assess the proposed activities in terms of their own functions, interests and activities. This approach went beyond advice received from WAFIC who recommended contacting only those operating within the Activity Area, as the activities outlined in this EP are considered routine for the industry. Shell sent letters to the WA commercial fishers identified outside of the Activity Area but within the Planning Area as an additional courtesy (where email was not available).
- Appendix B summarises the fisheries related feedback.

5.8.10 Indigenous People

Shell acknowledges Indigenous People are Australia's First Peoples and the Traditional Owners of the land and waters on which we work and live. With over 120 years of operations in Australia, Shell has developed proud partnerships with more than thirty Indigenous communities. Shell is committed to building meaningful relationships with Indigenous communities based on honesty, integrity, and respect.

The Full Federal Court has held that titleholders should adopt pragmatic and practical approaches to consultation in accordance with section 25 of the OPGGS(E) Regulations. This includes properly notified and conducted meetings, or other engagements that facilitate genuine two-way dialogue between the titleholder and relevant persons. Consultation methods may be guided by the preferences of Native Title Representative Bodies (NTRBs), Registered Native Title Bodies Corporate (RNTBCs) or Prescribed Body Corporates (PBCs). Meetings should be widely advertised to ensure appropriate representation. However, it is recognised that meetings may not be attended by all members of a group.

When approaching consultation with Indigenous relevant persons, Shell adopted a broad approach, reviewing the Planning Area, which approaches a number of Native Title determinations (Figure 7-32, Section 7.9.3.2) with a further 50 km buffer for all searches to ensure a broad capture of potentially relevant persons.

This identified >50 Aboriginal organisations including:

- Land Councils.
- Aboriginal Land Trusts – which exist in the Northern Territory and include land held in trust for use by Aboriginal people by another entity.
- Native Title Representative Bodies (NTRB).
- Registered Native Title Bodies Corporate (RNTBCs – the formal name given to a group once Native Title has been determined).
- Prescribed Bodies Corporate (PBCs – the legal entity formed by a group of Native Title Claimants during the determination process but used interchangeably with RNTBC).
- Aboriginal Corporations – Aboriginal run or managed businesses, often operating on behalf of, or under a RNTBC, but also independently, and including Aboriginal Tourism providers.
- Land and Sea Management Groups – primarily Ranger Groups, many of whom operate under a RNTBC, but some who operate independently on an IPA, or as the result of an ILUA.
- Aboriginal Arts and Cultural centres.
- Native Title Claim groups.
- Advisory Committees.
- Individuals.

Following extensive research and community consultation, it was clear that not all groups considered themselves responsible for cultural and spiritual care of land and sea to equal or similar degrees. For example:

- NTRBs, including NLC and KLC, often provide administration services such as payroll, legal and human resource services to RNTBCs or PBCs who have chosen to use the NTRB as an umbrella organisation under which to function, in addition to their primary role of assisting with matters pertaining to Native Title claims and determinations. NTRBs were used by Shell where appropriate to advise on Indigenous groups who could be relevant or have Sea Country or are located on the coast, preferred consultation approaches and to distribute consultation information to RNTBCs as deemed appropriate by the NTRB. However, the NTRBs do not consider it appropriate to represent the views of the RNTBCs or other groups who use their services, although in some circumstances they operate as a conduit or formal contact point for RNTBCs.
- Where an Aboriginal corporation operates under the umbrella of a RNTBC, they tend to be focused on running a business or service, and Native Title responsibilities (land and sea care and management) falls to the RNTBC and other appropriate sub-groups. This includes most (but not all) tourism service providers.

- Advisory Committees are comprised of individual RNTBCs, Ranger Groups and other Land Management groups, and do not speak with one voice on land, sea, and cultural values.
- Arts and Cultural Centres tend to be focused on their business, and again, defer land and sea cultural issues to the appropriate PBC or RNTBC.

Shell adopted a culturally appropriate and tailored approach with Indigenous relevant persons, complementing the broader community engagement outlined in this EP. This included adapting presentation materials and verbal communication to reflect the specific functions, interests, activities and cultural sensitivities for each group. For example, Shell used local imagery on title slides and included Acknowledgement of Country and with verbal tailoring which can be evidenced within meeting summaries, emails or minutes within Appendix B.

At the outset, Shell introduced a co-design strategy to Indigenous relevant persons and representative bodies such as NTRBs, offering flexible consultation formats including on-Country visits, meetings, yarning circles, and phone calls. This enabled Indigenous persons or their representatives to lead the engagement process, ensuring it was respectful, culturally appropriate, and responsive to their preferences.

Recognising potential communication barriers, Shell ensured information was conveyed in plain language through verbal, visual, and written formats. The co-design approach also aimed to reduce consultation fatigue and respect cultural obligations.

To implement this strategy and demonstrate reasonable efforts, Shell incorporated specific suggestions from Indigenous organisations—particularly NTRBs like KLC—throughout the consultation period. These included:

- Receiving advice from NTRBs on appropriate contacts for RNTBCs.
- Prioritising face-to-face meetings where feasible.
- Establishing rapport through direct phone contact with known Indigenous leaders.
- Offering meetings at times and locations chosen by the relevant persons.
- Conducting meetings in formats agreed upon by both parties (e.g., TEACA).

Shell's approach reflects a commitment to meaningful, respectful, and culturally informed engagement with Indigenous communities.

5.8.10.1 Contact methodology for Indigenous People

To help Shell better prioritise its consultation efforts, a tiering approach was implemented, refer Table 5-10.

Key Indigenous groups have been categorised into Tiers 0–3 based on proximity and potential for interaction with the proposed activities.

Regardless of the tier assigned to a group, Shell's overarching approach is to be collaborative and responsive in consultation, incorporating Indigenous People's feedback on preferred consultation methods, no matter what tier they are assigned.

Table 5-11, Table 5-12 and Table 5-13 are intended to demonstrate that consultation has been carried out for all Tier 1 and Tier 2 Indigenous relevant persons. The full summary of consultation for all relevant persons is provided in Appendix B.

Table 5-10: Approach to Consultation with Relevant Indigenous Persons and Organisations

Shell may adjust tiering to reflect Indigenous relevant persons who identify cultural values and features throughout the consultation process for this, or previous EPs, and/or are identified as important to the broader Shell operational footprint.

Contact Methodology	Overview of Indigenous Relevant Person	Indigenous Relevant Persons	Efforts to initiate consultation
Tier 0	• Direct planned impact to functions, interests, or activities of PBC, NTRB or RNTBC or those they represent. • Includes planned desecration or potential significant impacts to known cultural values or features.	Shell has not identified any Indigenous relevant persons who have interests or activities such as cultural values or features within the Activity Area of this EP which will be impacted by the planned impacts of the activities. This is supported by an independent Underwater Cultural Heritage survey by Cosmos Archaeology in 2023 which stated there are no tangible Indigenous features in the Activity Area as it is beyond the ancient coastline at 130 m below lowest astronomical tide (LAT), where there has never been any human occupation.	As a minimum, this would include genuine two-way dialogue with a representative of the communal interest affected seeking to reach agreement on the levels of proposed impacts to the cultural feature or value.
Tier 1	• Closest to planned activities – located/or with Sea Country within 150 km of the Activity Area on the Australian mainland, in the Kimberley, WA. • PBC, NTRB or RNTBC (excluding Tier 0). • Aboriginal corporation functioning under the authority of an RNTBC (excluding Tier 0). Table 7-1 further supports the conservative assessment of 150km based on noise and light modelling not expected to extend beyond ~104 km from the facility location.	• Kimberley Land Council (KLC) • Northern Land Council (NLC)	Precedence placed on consultation with these groups with focussed efforts, including attempting to contact by multiple forms of communication and seeking to establish long term relationships, where not already established and sought by relevant group.

Contact Methodology	Overview of Indigenous Relevant Person	Indigenous Relevant Persons	Efforts to initiate consultation
Tier 2	• Those coastally adjacent to the Planning Area, defined as areas of coastline which are within 150 km of the Planning Area[5]. • PBC, NTRB or RNTBC who are coastally adjacent to the Planning Area[6] (excluding Tier 0, Tier 1 and Tier 3). • Aboriginal corporations who are coastally adjacent to the Planning Area (excluding Tier 0, Tier 1 and Tier 3).	Given the volume of tier 2 relevant persons for this EP, they have been grouped under WA and NT: **Western Australia** • Balanggarra Aboriginal Corporation • Bardi and Jawi Niimidiman Aboriginal Corporation (BJNAC) • Bidyadanga Aboriginal Community La Grange Inc. • Dambimangari Aboriginal Corporation • Djarindjin Aboriginal Corporation (DAC) • Gogolanyngor Aboriginal Corporation • Goolarabooloo Millibinyarri Indigenous Corporation • Joombarn-Buru Aboriginal Corporation • Kalumburu Aboriginal Corporation • Karajarri Traditional Lands Association (KTLA) • Kimberley Indigenous Saltwater Advisory Group (ISWAG) • Kimberley Ranger Network • Kullari Regional Communities Incorporated (KRCI) • Lombadina Aboriginal Corporation (LAC) • Mayala Inninalang Aboriginal Corporation (incl Mayala 2) • Miriuwung-Gajerrong (Western Australia) • Nimanburr Aboriginal Corporation • Nyamba Buru Yawuru Aboriginal Corporation • Nyul Nyul PBC Aboriginal Corporation • Walalakoo Aboriginal Corp • Wanjina-Wunggurr Aboriginal Corporation	Concerted effort to contact these groups by attempting multiple forms of communication as necessary, to gather inputs on cultural values or features and other matters to inform preparation of this EP.

[5] *Beyond 150 km from the Planning Area, there are deemed to be no 'coastally adjacent' areas to the Planning Area and therefore relevant persons are deemed too far away to be impacted more than an immaterial or negligible way.*

Contact Methodology	Overview of Indigenous Relevant Person	Indigenous Relevant Persons	Efforts to initiate consultation

		• Wilinggin Aboriginal Corporation
		• Wunambal Gaambera Aboriginal Corporation
		Northern Territory
		• Larrakia Development Corporation
		• Larrakia Nation Aboriginal Corporation
		• Munupi Aboriginal Corporation
		• NLC groups:
		  ○ Arnhem Land Aboriginal Land Trust
		  ○ Delissaville/Wagait/Larrakia Aboriginal Land Trust
		  ○ Cobourg Pensinsula Sanctuary Land Trust
		  ○ Croker Island
		  ○ Dak Djerat Guwe People
		• Thamurrur Development Corporation
		• Tiwi Land Council (TLC) representing the following clan groups:
		  ○ Jikilaruwu (Bathurst Island)
		  ○ Malawu (Bathurst Island)
		  ○ Mantiyupwi (Bathurst and Melville Island)
		  ○ Marrikawuyanga (Melville Island)
		  ○ Munupi (Melville Island)
		  ○ Wulirankuwu (Melville Island)
		  ○ Wurankuwu (Bathurst Island)
		  ○ Yimpinari (Melville Island)
		• Top End Aboriginal Coastal Alliance (TEACA)
		  ○ Cobourg First Nations Consultative Committee
		  ○ Djulidki First Nations Consultative Committee
		  ○ Gapu Maringa First Nations Consultative Committee
		  ○ Goulburn Islands First Nations Consultative Committee
		  ○ Jindiwi First Nations Consultative Committee
		  ○ Kardu Lalingkin First Nations Consultative Committee
		  ○ Maningrida Regional First Nations Consultative Committee	

Contact Methodology	Overview of Indigenous Relevant Person	Indigenous Relevant Persons	Efforts to initiate consultation
		○ Mulurryud First Nations Consultative Committee ○ Ngoy Garmak First Nations Consultative Committee ○ Rak Badjalarr First Nations Consultative Committee ○ Tiwi Clans First Nations Consultative Committee	
Tier 3	• PBC, NTRB or RNTBC whose members are at the periphery of the Planning Area (excluding Tiers 0–2). • All other Indigenous People or organisations.	Remaining Indigenous relevant persons.	Emailed sufficient information with at least one follow-up.

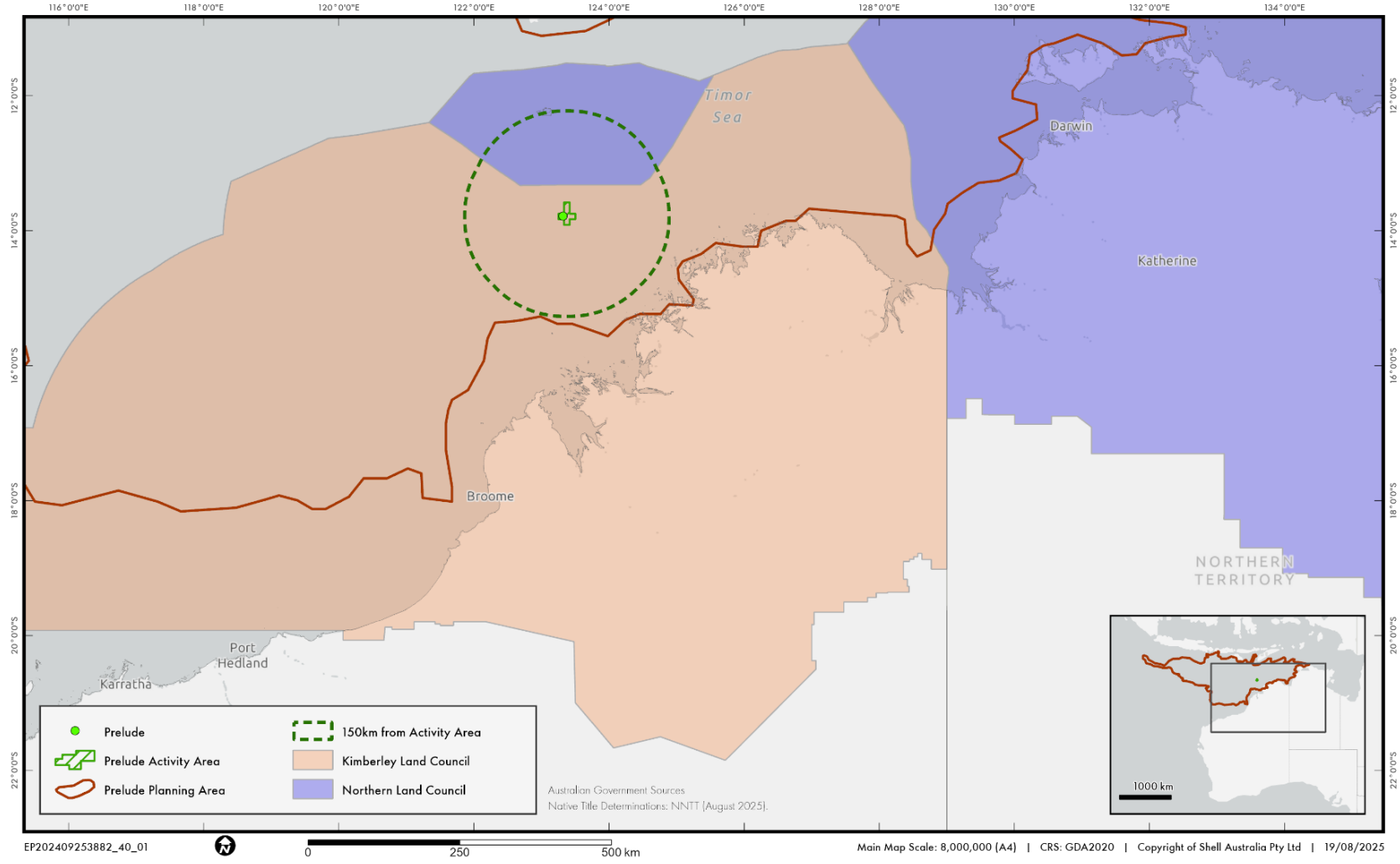


Figure 5-3: Shell Identified Tier 1 Indigenous Relevant Persons

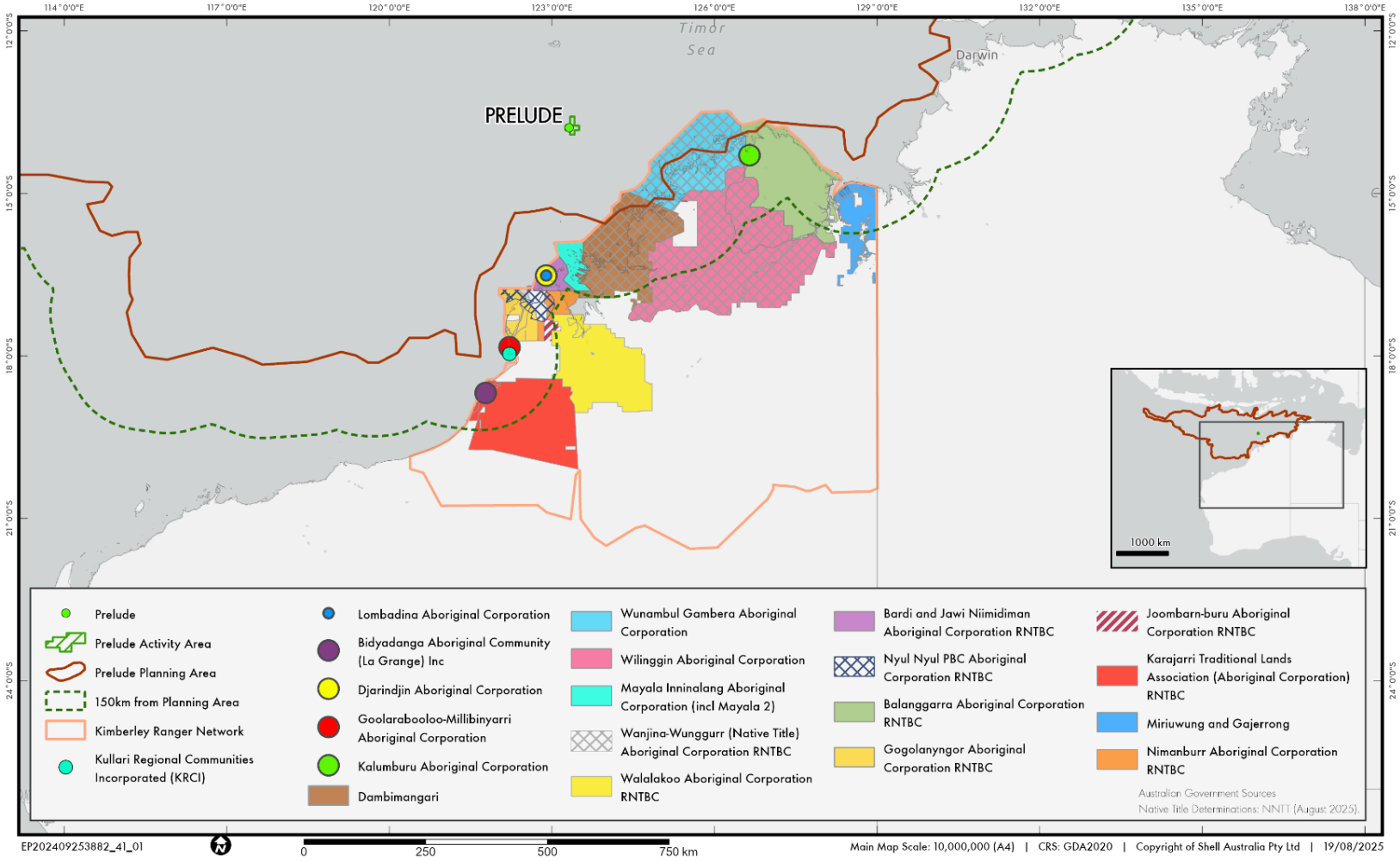


Figure 5-4: Shell Identified Tier 2 Indigenous Relevant Persons WA (excludes groups where spatial data was not available)

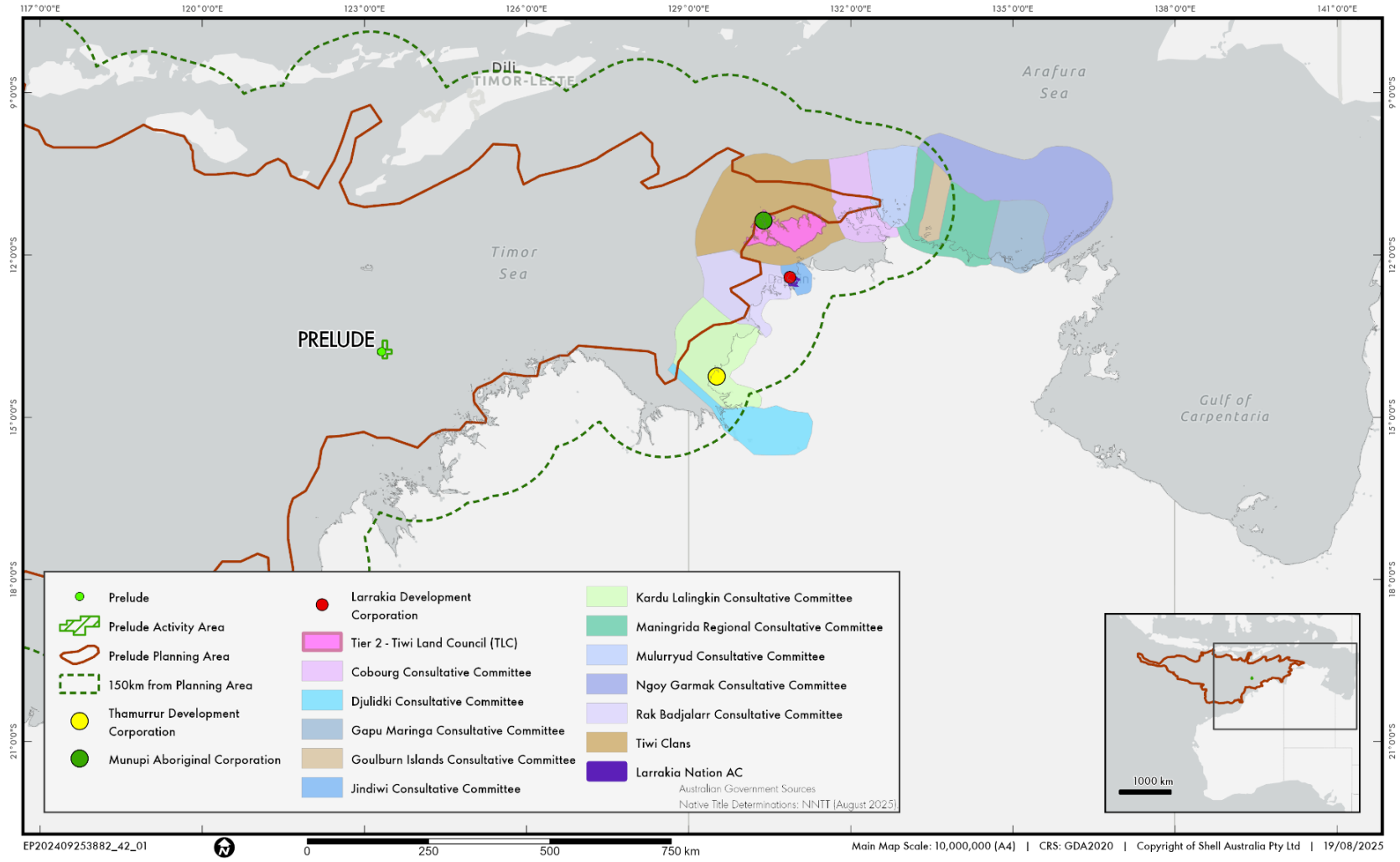


Figure 5-5: Shell Identified Tier 2 Indigenous Relevant Persons NT (excludes groups where spatial data was not available)

Table 5-11: Tier 1 Indigenous Relevant Persons Consultation Completion Statement

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum Activity Impacts and Risks which May Affect Relevant Persons Functions, Interests, or Activities	Nature and Scale of Effect on Relevant Persons Functions, Interests, or Activities	Sufficient Information Provided	Consultation Overview / Efforts to Consult For a full summary of contact, see Appendix B	Reasonable Period Provided	Appropriate Measures Adopted
38. Kimberley Land Council (KLC)	KLC has a function as the NTRB in relation to the administration of Native Title and may represent Native Title applicants and holders' interests in relation to existing Native Title claims and determinations that extend into Sea Country. They are also the contact point for the following specific RNTBCs, PBCs or Native Title applicants identified as relevant persons for the purposes of this EP. 122. Balanggarra Aboriginal Corporation 33. Gogolanyngor Aboriginal Corporation 39. Kimberley Ranger Network 56. Madanaa Nada Aboriginal Corporation 113. Nimanburr Aboriginal Corporation 51. Nyul Nyul PBC Aboriginal Corporation 55. Wanjina Wunggurr (Native Title) Aboriginal Corporation including Wunambal Gaambera Aboriginal Corporation, Dambimangari Aboriginal Corporation and Willinggin Aboriginal Corporation 541. Nyangumarta Karajarri Aboriginal Corporation KLCs have the potential Functions, Interests and Activities: Sea Country. Cultural values. Cultural features. Indigenous traditional activities (e.g., fishing). Responsible for Sea Country within the Kimberley Marine Park.	Spill risks have the potential to affect KLC's, functions, interests, or activities or the RNTBCs, PBCs or Aboriginal Corporations they represent.	Low, in accordance with Table 5 3: Division 3 – Section 25 of the OPGGS(E) Regulations, KLC's area of responsibility as an NTRB overlaps with the Planning Area. KLC's interests and activities do not extend near the Activity Area. There are no planned impacts predicted to KLC's functions, interests, and activities. They may be affected to a limited extent if a major spill event were to occur.	Information sheets were provided to KLC on 12 December 2024. Shell shared the draft EP on 24 September 2025. Shell published in social media, radio and newspapers which were targeted at groups or individuals within this region from February to April 2025. (Appendix A).	As the peak Indigenous body in the Kimberley, KLC were also engaged to make contact with the RNTBCs, PBCs and Aboriginal Corporations they represent. The KLC is the formal contact point for the groups outlined in the second column of this table. While KLC is the formal contact point, Shell has also made direct contact with groups that KLC represents. Shell has been attempting to meet face to face with KLC since March 2023 for previous EPs. For the purposes of consultation for this EP, KLC received sufficient information on 12 December 2024. A reminder email was sent on 11 March 2025. Shell called KLC on 13 May 2025, but the contact was not available. Shell called again on 7 July 2025 related to consultation with Nimanburr and correct contact details. KLC confirmed that contact should now be made directly with Nimanburr. Shell called again on 13 August 2025, reiterating the offer to consult. Shell provided a final opportunity on the 30 September 2025 for KLC to provide input to Shell for EP preparation, sharing the draft EP, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. Throughout all consultation with KLC, and the groups it is the formal contact point for, no objections or claims have been raised. From February 2025, Shell undertook a targeted media campaign in the region, using print, geotargeted social media and radio ads. The campaign urged potentially relevant persons to contact Shell and provided a link to the Prelude project on the Shell website with access to the draft EP from 24 September 2025. These materials enabled relevant persons to make an informed decision about how their functions, interests, or activities may be affected, and a mechanism to consult with Shell on the EP– Appendix A. Shell's further reasonable efforts to consult has been demonstrated through offers to cover all reasonable costs associated with attending consultation meetings/forums (e.g., accommodation, travel and where appropriate reasonable costs of time) and contact details for environmental consultants, some independent, paid for by Shell to support the relevant persons in assessing information and providing feedback to Shell. Shell considers that KLC and the organisations it is the formal contact point for have been afforded a reasonable opportunity to consult with Shell in preparing this EP.	Shell has been reaching out to KLC since December 2024. Sufficient information (such as information sheets and website) was provided to KLC in December 2024. The KLC was also requested to forward it on to other RNTBCs, PBCs and Aboriginal Corporations. KLC had more than 6 months to review the information, and make an informed assessment about how their functions, interests or activities may be affected. Shell also shared the draft EP with KLC on 30 September 2025 giving an additional one month with the full EP. It also allowed reasonable time to digest information provided and to access the offer of a consultant panel to support them in reviewing information and raising issues or input on Shell's proposed activity. Shell considers that KLC and the community it represents have been afforded a reasonable period to understand how this EP impacts their functions, interests or activities and engage with Shell for further discussion.	No measures were adopted for this EP.
Justification that the Regulation 25 obligations and Regulation 34(g) acceptance criteria have been met. KLC is the peak Indigenous body and NTRB in the Kimberley region working with Indigenous People to secure Native Title, conduct conservation and land management activities and develop cultural business enterprises. Shell has provided sufficient information and a reasonable period for consultation with the KLC as demonstrated by the provision of information. Shell also requested that KLC share the information provided with the groups they represent to ensure they also get sufficient information and a reasonable period to							

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum Activity Impacts and Risks which May Affect Relevant Persons Functions, Interests, or Activities	Nature and Scale of Effect on Relevant Persons Functions, Interests, or Activities	Sufficient Information Provided	Consultation Overview / Efforts to Consult For a full summary of contact, see Appendix B	Reasonable Period Provided	Appropriate Measures Adopted
provide input, claims or objections. Shell has adopted appropriate measures related to all relevant matters raised by KLC during consultation where suggestions were made on how to better reach members, they support which may be affected by the activities of this EP. Therefore, consultation has been completed in accordance with section 34(g) of the OPGGS(E) Regulations.							
114. Northern Land Council (NLC)	NLC represents Indigenous People located in the Top End of the Northern Territory of Australia. NLC has a function as the NTRB in relation to the Ashmore and Cartier Islands area. NLC are also the contact point for the following specific RNTBCs, PBCs or Native Title applicants identified as relevant persons for the purposes of this EP: 74. Arnhem Land Aboriginal Land Trust 78. Bulgul Land and Sea (Management) Rangers 80. Croker Island 81. Dak Djerat Guwe People 82. Delissaville / Wagait / Larrakia Aboriginal Land Trust 85. Garngi Land and Sea Management / Garngi Community Rangers 99. Legune Pastoral Lease 100. Malak Malak Land and Water Management Rangers 103. Mardbalk Land and Sea Management / Warruwi Community Mardbalk Marine Rangers 530.Top End Aboriginal Corporation RNTBC 601. Kenbi Rangers 603. Cobourg Peninsula Sanctuary Land Trust	Spill risks have the potential to affect NLC's, functions, interests, or activities.	Low, in accordance with Table 5 3: Division 3 – Section 25 of the OPGGS(E) Regulations NLC's area of responsibility as an NTRB overlaps with the Activity Area and Planning Area. There are no planned impacts predicted to NLC's functions, interests, and activities. They may be affected to a limited extent if a major spill event were to occur.	Information sheets were provided to NLC on 10 April 2024. Shell shared the draft EP on 24 September 2025. Shell published in social media, radio and newspapers which were targeted at groups or individuals within this region from February to April 2025. (Appendix A).	As the peak Indigenous body in the Northern Territory and Ashmore and Cartier Island territories, NLC was requested by Shell to forward information to NLC members outlined in the second column of this table. Shell has been consulting with NLC since March 2023 for previous EPs. For the purposes of consultation on this EP, NLC received sufficient information on 16 December 2024. Shell sent a reminder email on 11 March 2025 and received an out of office, so Shell forwarded the reminder email to the new contact details. Shell made an attempt to call NLC on 5 May, with no response. On 18 July, Shell emailed NLC again with full list of relevant persons for NLC to forward details on to. On 08 September, Shell spoke to the legal counsel at NLC who provided new contact details. They indicated that given the distant location of Prelude, it was unlikely to be of interest. Shell provided a final opportunity on the 24 September 2025 for NLC to provide input to Shell for EP preparation, sharing the draft EP, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. Throughout all consultation with NLC, and the groups it's members, no objections or claims have been raised. From February 2025, Shell undertook a targeted media campaign in the region, using print, geotargeted social media and radio ads. The campaign urged potentially relevant persons to contact Shell and provided a link to the Prelude project on the Shell website with access to the draft EP from 25 September 2025. These materials enabled relevant persons to make an informed decision about how their functions, interests, or activities may be affected, and a mechanism to consult with Shell on the EP– Appendix A. Shell's further reasonable efforts to consult has been demonstrated through offers to cover all reasonable costs associated with attending consultation meetings/forums (e.g., accommodation, travel and where appropriate reasonable costs of time) and contact details for environmental consultants, some independent, paid for by Shell to support the relevant persons in assessing information and providing feedback to Shell. Shell considers that NLC has been afforded a reasonable opportunity to consult with Shell in preparing this EP.	Shell has been reaching out to NLC since December 2024 when sufficient information (such as information sheets and website) was provided to them. NLC had more than 6 months to review the information, and make an informed assessment about how their functions, interests or activities may be affected. Shell shared the draft EP on 24 September 2025, giving an additional one month with the full EP. Shell also allowed reasonable time to digest information provided and to access the offer of a consultant panel to support NLC in reviewing information and raising issues or input on Shell's proposed activity. Shell considers that NLC and the community it represents have been afforded a reasonable period to understand how this EP impacts their functions, interests or activities and engage with Shell for further discussion.	No measures were adopted for this EP.
Justification that the Regulation 25 obligations and Regulation 34(g) acceptance criteria have been met. NLC is the peak Indigenous body and NTRB in the north part of the Northern Territory and Ashmore and Cartier Island Territories. Shell has provided sufficient information and a reasonable period for consultation with the NLC as demonstrated by the provision of information. Therefore, consultation has been completed in accordance with section 34(g) of the OPGGS(E) Regulations.							

Table 5-12: Tier 2 Indigenous Relevant Persons Consultation Completion Statement - WA

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
122. Balanggarra Aboriginal Corporation (BAC) **29. Bardi and Jawi Niimidiman Aboriginal Corporation (BJNAC)** **77. Bidyadanga Aboriginal Community La Grange Inc.** **31. Dambimangari Aboriginal Corporation (DAC)** **32. Djarindjin Aboriginal Corporation (DAC)** **33. Gogolanyngor Aboriginal Corporation** **87. Goolaraboolo Millibinyarri Indigenous Corporation** **35. Joombarn-Buru Aboriginal Corporation** **93. Kalumburu Aboriginal Corporation** **36.Karajarri Traditional Lands Association (KTLA) (Including Nyangumarta Karajarri Aboriginal Corporation)** **39. Kimberley Ranger Network** **41. Kullari Regional Communities Incorporated (KRCI)** **42. Lombadina Aboriginal Corporation (LAC)** **44. Mayala Inninalang Aboriginal Corporation (incl Mayala 2)** **105. Miriuwung-Gajerrong (Western Australia)** **113. Nimanburr Aboriginal Corporation** **49. Nyamba Buru Yawuru AboriginalCorporation** **51. Nyul Nyul PBC Aboriginal Corporation**	All more than 200 km from the Activity Area to the closest part of Native Title interest and other known potential interests or activities. The NRTBs and Aboriginal Corporations represent the interests of the groups they represent and their Country, located coastally adjacent to the Planning Area. • Cultural heritage values. • Cultural heritage features. • Indigenous traditional activities (e.g. fishing).	Spill risks have the potential to affect the relevant persons functions, interests, or activities.	Low, in accordance with Table 5 3: Division 3 – Section 25 of the OPGGS(E) Regulations. There are no planned impacts from the Shell's activities predicted to occur to these relevant persons functions, interests, and activities. Their functions, interests and activities do not extend near the Activity Area. They may be affected if a major spill event were to occur.	Information sheets were provided to relevant persons in December 2024. Follow up emails were sent, and phone calls were made in March to October 2025. The draft EP was shared in September/October 2025. Shell published in social media, radio and newspapers which were targeted at groups or individuals within this region from February to April 2025 (Appendix A).	All relevant persons have been provided with sufficient information in December 2024, a follow up email in March 2025 and the draft EP in September 2025. Shell's further reasonable efforts to consult with all these relevant persons has been demonstrated through offers to all relevant persons to cover all reasonable costs associated with attending consultation meetings/forums (e.g., accommodation, travel and where appropriate reasonable costs of time). Shell also shared contact details of environmental consultants, paid, for by Shell to support the relevant persons in assessing information and providing feedback to Shell. From February 2025, Shell undertook a targeted media campaign in the region, using print, geotargeted social media and radio ads. The campaign urged potentially relevant persons to contact Shell and provided a link to the Prelude project on the Shell website with access to the draft EP from 24 September 2025. These materials enabled relevant persons to make an informed decision about how their functions, interests, or activities may be affected, and a mechanism to consult with Shell on the EP – Appendix A. More detailed consultation summaries and a full text record for these relevant persons can be found in Appendix A). Shell considers that all these relevant persons and the communities they represent have been afforded a reasonable opportunity to consult with Shell in preparing this EP. A short overview of the consultation approach for each of	Shell has been reaching out to these relevant persons since December 2024 when sufficient information was provided by email with information sheets and a website link. The draft EP was made available in September/October 2025. Reasonable period has also been allowed to disseminate and digest information provided and to access the offer of the independent consultant panel to support them in reviewing information and raising issues or input with Shell's proposed activity. Shell has also provided offers of financial support to help participate in the consultation process.	Joombarn-Buru Aboriginal Corporation claimed that transiting helicopters from offshore facilities hold up commercial flights from Broome to Perth. Shell investigated and while the data did not support that this was related to transiting Shell employees, Shell strengthened an existing measure to ensure that no delays should be requested on flights used for demobilisation of Shell staff.

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
54. Walalakoo Aboriginal Corporation (WAC) **125. Wunambal Gaambera Aboriginal Corporation (WGAC)** **55. Wanjina-Wunggurr (Native Title) Aboriginal Corporation (WWAC)** **57. Wilinggin Aboriginal Corporation**					the tier 2 relevant persons in WA is as follows: **122. Balanggarra Aboriginal Corporation (BAC)** BAC received sufficient information on 13 December 2024. A reminder email was sent on 11 March 2025. Shell held community sessions in Wyndham on 18 March and in Kununurra on 19 March. On 29 July 2025, Shell attempted to call BAC with no answer. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No response has been received. **29. Bardi and Jawi Niimidiman Aboriginal Corporation (BJNAC)** BJNAC received sufficient information on 24 March 2025. On 1 May 2025, BJNAC reached out to Shell in relation to the consultation protocol, which Shell responded to on 20 May. Shell attempted to call BJNAC on 5 June with no response. Shell sent a follow up email on 6 June 2025. Shell received an email from BJNAC on 18 September regarding another matter, but also proposing an October visit regarding this EP. Shell responded to that email on 06 October seeking availability to meet. The draft EP was shared on 06 October 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					objections or claims they may have about the activity. In early December 2025there were a number of phone calls and emails related to progressing a meeting for the 26th February 2026 which was the earliest available time for all parties to meet. However, this meeting didn't go ahead and a new date is yet to be scheduled. **77. Bidyadanga Aboriginal Community La Grange Inc.** Bidyadanga received sufficient information on 2 December 2024. A reminder email was sent on 5 March 2025. On 29 July 2025, Shell called Bidyadanga and spoke with the CEO who confirmed that emails had been received. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No further response has been received. **31. Dambimangari Aboriginal Corporation (DAC)** DAC received sufficient information on 13 December 2024 following an in person meeting prior to that on 4 December 2024. DAC confirmed that they were satisfied with information provided and so the subsequent meeting planned for February didn't go ahead. Shell received an invitation in March from DAC to attend a Board meeting in April to present on Underwater Cultural Heritage.		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					At the request of DAC, this meeting was held on 20 August 2025. The draft EP was shared on 01 October 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. **32. Djarindjin Aboriginal Corporation (DAC)** DAC received sufficient information on 13 December 2024. DAC shared a meeting schedule for 2025 with Shell on 13 December. On 20 January 2025, Shell reached out to DAC to check availability to meet, and DAC confirmed their May Board meeting which Shell confirmed. Over the course of February and March, Shell and DAC exchanged emails with a view to attending the May Board Meeting. The May Board meeting was rescheduled to a time which Shell could not attend so arrangements were made to attend in July. Shell had to postpone this date due to illness, and the meeting took place on 28 August 2025. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. **33. Gogolanyngor Aboriginal Corporation (GAC)** GAC received sufficient information on 13 December 2024. On 16		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					December, GAC emailed with new contact information, so Shell re-sent the sufficient information to the new contact on 16 December. A reminder email was sent on 11 March 2025. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No further response has been received. **87. Goolarabooloo Millibinyarri Indigenous Corporation** Goolarabooloo received sufficient information on 16 December 2024. A reminder email was sent on 11 March. On 29 July 2025, Shell attempted to call Goolarabooloo with no answer. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No response has been received. **35. Joombarn-Buru Aboriginal Corporation (JBAC)** JBAC received sufficient information on 13 December 2024. Shell and JBAC exchanged emails over January 2025 related to attending a Board meeting in April. In March, Shell advised JBAC that we were unable to attend the April Board meeting due to Senior		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					Leader availability. JBAC offered an alternate meeting time in June. On 18 June 2025, Shell met with JBAC. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. **93. Kalumburu Aboriginal Corporation** Kalumburu received sufficient information on 13 December 2024. A reminder email was sent on 11 March 2025. Shell held a community session in Kununurra and Wyndham on 18 and 19 March 2025. Shell called Kalumburu on 22 July and to reiterate offer to consult and subsequently resent sufficient information on 23 July. On 24 July, Shell made contact with the CEO and arranged a Teams meeting, which occurred on 30 July 2025. On 4 August, Kalumburu emailed requesting further information on this EP, which was shared with them on 4 August. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. On 11 December, Kalumburu emailed to advise they had reviewed the Prelude EP documentation and would be discussing it at their December		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					Board meeting. Shell received a further email, which came via our Environment Panel, on 18 February which included their position statement. Shell responded on 18 March. A Teams meeting was held on 23 April to share information on the project. **36. Karajarri Traditional Lands Association (KTLA)** KTLA received sufficient information on 16 December 2024. A reminder email was sent on 11 March 2025. Shell called KTLA on 29 July 2025, and they confirmed emails had been received and that they would be in touch if they wanted Shell to present to the Board. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. **39. Kimberley Ranger Network (KRN)** KRN received sufficient information on 13 December 2024. A reminder email was sent on 11 March 2025. On 18 July 2025, Shell emailed KRN with the offer to meet. KRN responded on 22 July to confirm material had been received and they would get back to Shell. Shell met with KRN on 23 September 2025 and presented information on tis EP. The draft EP was shared on 01 October 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. **41. Kullari Regional Communities Incorporated (KRCI)** KRCI received sufficient information on 16 December 2024. A reminder email was sent on 7 March 2025. On 29 July 2025, Shell called KRCI who confirmed they had received email correspondence. The CEO confirmed they would call back if they require further information. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No further response has been received. **42. Lombadina Aboriginal Corporation (LAC) Including Lombadina Accommodation & Tours** LAC received sufficient information on 2 December 2024. A reminder email was sent on 7 March 2025. Shell attempted to call LAC on 5 September 2025 but there was no answer. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					objections or claims they may have about the activity. No response has been received. **44. Mayala Inninalang Aboriginal Corporation (incl Mayala 2) (MIAC)** MIAC received sufficient information on 13 December 2024. MIAC responded to this email on 16 December 2024 to confirm they would be in touch in February. A reminder email was sent on 11 March 2025. Shell tried to call Mayala on 23 July with no answer. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No further response has been received. **105. Miriuwung-Gajerrong (Western Australia) (MG Corp)** MG Corp received sufficient information on 13 December 2024. A reminder email was sent on 11 March 2025. On 18 and 22 July 2025, Shell called MG Corp with no answer. Shell hosted the community sessions in Kununurra at the MG Corp language centre. No one from MG Corp attended. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					objections or claims they may have about the activity. No response has been received. **113. Nimanburr Aboriginal Corporation** Nimanburr received sufficient information on 13 December 2024. A reminder email was sent on 11 March 2025. Shell called KLC on 7 July, and were advised to contact Nimanburr directly, which Shell sent on 7 July with sufficient information. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No response has been received. **541. Nyangumarta Karajarri Aboriginal Corporation** Shell made a few efforts to reach out directly to Nyangumarta Karajarri Aboriginal Corporation when it transpired that a KLC contact was listed for them. Consultation then took place through KLC. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. **51. Nyul Nyul PBC Aboriginal Corporation** Nyul Nyul PBC received sufficient information on 13 December 2024.		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					Nyul Nyul confirmed receipt on 13 December. A reminder email was sent on 11 March 2025, and Nyul Nyul responded with an offer to present at their May Board meeting, which Shell accepted. Despite some follow up, this meeting did not occur. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. **54. Walalakoo Aboriginal Corporation (WAC)** WAC received sufficient information on 13 December 2024 and Shell sent a reminder email on 11 March 2025. Shell called WAC on 13 May 2025 and was provided with a new contact. Shell attempted to reach that contact without success. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No response has been received. **55. Wanjina-Wunggurr (Native Title) Aboriginal Corporation (WWAC)** WWAC received sufficient information on 13 December 2024 and Shell sent a reminder email on 11 March 2025.		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					On 9 May, Shell called KLC and was advised to contact the person listed on ORIC, which Shell attempted to do without success. On 13 May, Shell called KLC again and was told to email (rather than call) the ORIC contact. On 14 May, Shell re-sent sufficient information in an email to the new ORIC contact. WWAC responded on 15 May with an offer to attend their next Board meeting, which Shell accepted. On 20 May, Shell met with WWAC to present on this EP. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. **57. Wilinggin Aboriginal Corporation** Shell emailed sufficient information on 13 December 2024 and sent a reminder email on 11 March 2025. Shell held a drop-in session on 9 April 2025 in Derby. Wilinggin legal representative advised of a new CEO contact in April and confirmed they had forwarded sufficient information to them. Shell reached out to the new contact on 5 May 2025. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No response has been received.		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					125. Wunambal Gaambera Aboriginal Corporation (WGAC) WGAC received sufficient information on 13 December 2024 and a reminder email on 11 March 2025. Shell attempted to call WGAC on 5 May 2025 with no answer. Representatives from WGAC attended a consultation with WWAC on 20 May. At that meeting WGAC invited Shell to consult directly with them on country at Truscott. Shell confirmed we would take up that offer and Shell emailed WGAC on 28 May 2025 to follow up the offer to meet. Shell called on 13 August 2025 and spoke to reception. Shell then called the GM and left a voicemail. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. **49. Yawuru Native Title Holders Aboriginal Corporation RNTBC** Yawuru Native Title Holders Aboriginal Corporation RNTBC received sufficient information on 13 December 2024. A reminder email was sent on 11 March 2025. On 1 July 2025, Shell called Yawuru Native Title Holders Aboriginal Corporation RNTBC with an offer to consult. On 7 April Yawuru Native Title Holders Aboriginal Corporation RNTBC offered Shell to present at the August Board Meeting which Shell accepted. There were a number of phone calls and emails in the lead up to		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					the Teams meeting which was held on 21 August 2025. The draft EP was shared on 01 October 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity.		

Justification that the Regulation 25 obligations and Regulation 34(g) acceptance criteria have been met.

Shell has addressed all feedback received from Tier 2 relevant persons and adopted appropriate measures in the EP as required. All Tier 2 relevant persons functions, interests and activities are only potentially impacted by the spill risk from Shell's activities (through dissolved/entrained oil). Any impact to their functions, interests and activities is predicted to be slight. Other than source control options which are already planned to be implemented by Shell in the event of a spill, there are no other available options to directly mitigate or reduce the impacts of dissolved/entrained oil during spills which could occur from this activity. Therefore, further consultation is unlikely to improve risk management or further reduce the environmental impacts of a spill in accordance with the objects of consultation in preparing an EP. For relevant persons who did not respond to requests to provide feedback, Shell then made further attempts by alternate available means to elicit a response up until October 2025. Shell has provided sufficient information to inform these relevant persons how their functions, interests and activities may be affected, made reasonable efforts to consult with all of the relevant persons, provided a reasonable period for them to determine if their functions, interests, and activities may be affected, and to review information and provide feedback to Shell. Shell also adopted appropriate measures based on input from the relevant persons that did respond during consultation. Given the remote likelihood and scale of potential risks to their functions, interests and activities, consultation has been completed in accordance with section 34(g) of the OPGGS(E) Regulations.

Table 5-13: Tier 2 Indigenous Relevant Persons Consultation Completion Statement - NT

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
97. Larrakia Development Corporation **129. Larrakia Nation Aboriginal Corporation** **108. Munupi Aboriginal Corporation** **118. Thamurrur Development Corporation** **119. Tiwi Land Council (TLC) including:** • 91. Jikilaruwu (Bathurst Island) • 107. Munupi (Melville Island) • 101. Malawu (Bathurst Island) • 102. Mantiyupwi (Bathurst and Melville Island) • 104. Marrikawuyanga (Melville Island) • 531. Wulirankuwu (Melville Island) • 532. Wurankuwu (Bathurst Island) • 127. Yimpinari (Melville Island) **607. Top End Aboriginal Coastal Alliance (TEACA) including:**	All more than 200 km from the Activity Area to the closest part of Native Title interest and other known potential interests or activities. The NRTB's and Aboriginal Corporations represent the interests of the groups they represent and their Country, located coastally adjacent to the Planning Area. Cultural heritage values. Cultural heritage features. Indigenous traditional activities (e.g., fishing).	Spill risks have the potential to affect the relevant persons functions, interests, or activities.	Low, in accordance with Table 5 3: Division 3 – Section 25 of the OPGGS(E) Regulations. There are no planned impacts from Shell's activities predicted to occur to these relevant persons functions, interests, and activities. Their functions, interests and activities do not extend near the Activity Area. They may be affected if a major spill event were to occur.	Information sheets were provided to relevant persons in December 2024. Follow up emails and phone calls were sent in March to October 2025. The draft EP was shared in September/October 2025. Shell published in social media, radio and newspapers which were targeted at groups or individuals within this region from February to April 2025 (Appendix A).	All relevant persons were provided with sufficient information in December 2024 and the draft EP on 24 September 2025. Shell's further reasonable efforts to consult with all these relevant persons has been demonstrated through offers to all relevant persons to cover all reasonable costs associated with attending consultation meetings/forums (e.g., accommodation, travel and where appropriate reasonable costs of time) and also contact details for environmental consultants, some independent, paid for by Shell to support the relevant persons in assessing information and providing feedback to Shell. From February 2025, Shell undertook a targeted media campaign in the region, using print, geotargeted social media and radio ads. The campaign urged potentially relevant persons to contact Shell and provided a link to the Prelude project on the Shell website with access to the draft EP from 24 September 2025. These materials enabled relevant persons to make an informed decision about how their functions, interests, or activities may be affected, and a mechanism to consult with Shell on the EP –Appendix A. More detailed consultation summaries and full text record for these relevant persons can be found in Appendix A. Shell considers that all these relevant persons and the communities they represent have been afforded a reasonable opportunity to consult with Shell in preparing this EP. A short overview of the consultation approach for each of the Tier 2 relevant persons in the NT is as follows: **97. Larrakia Development Corporation**	Shell has been reaching out to these relevant persons since December 2024 when sufficient information was provided by email with information sheets and a website link. The draft EP was made available in September/October 2025. Reasonable period has also been allowed to disseminate and digest information provided and to access the offer of the independent consultant panel to support them in reviewing information and raising issues or input with Shell's proposed activity. Shell has also provided offers of financial support to help participate in the consultation process.	No other measures were adopted for this EP.

• 535. Cobourg First nations Consultative Committee • 610. Djulidki First Nations Consultative Committee • 538. Gapu Maringa First Nations Consultative Committee • 537. Goulburn Islands First Nations Consultative Committee • 533. Jindiwi First Nations Consultative Committee • 611. Kardu Lalingkin First Nations Consultative Committee • 536. Maningrida Regional First Nations Consultative Committee • 534. Mulurryud First Nations Consultative Committee • 539. Ngoy Garmak First Nations Consultative Committee • 609. Rak Badjalarr First Nations Consultative Committee • 540. Tiwi Clans First Nations Consultative Committee					Larrakia received sufficient information on 16 December 2024. A reminder email was sent on 25 July 2025 when Shell also attempted to call, with no answer. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No response has been received. **129. Larrakia Nation Aboriginal Corporation** Larrakia Nation Aboriginal Corporation received sufficient information on 13 December 2024. A reminder email was sent on 11 March 2025. On 13 March 2025, Larrakia confirmed they would advertise Shell's community session in Darwin and requested a meeting with Shell. Shell met with Larrakia Nation on 30 April 2025; however, their interest was in Shell's social investment programs rather than this EP. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. **108. Munupi Aboriginal Corporation** Munupi Aboriginal Corporation received sufficient information on 16 December 2024. A reminder email was sent on 23 April 2025. Shell attempted to call Munupi Aboriginal Corporation on 10 September 2025 with no answer. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					objections or claims they may have about the activity. No response has been received. **118. Thamurrur Development Corporation** Thamurrur Development Corporation received sufficient information on 16 December 2024. A reminder email was sent on 11 March 2025. Shell attempted to call Thamurrur on 25 July 2025 with no answer. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No response has been received. **119. Tiwi Land Council (TLC)** TLC received sufficient information on 13 December 2024. A reminder email was sent on 25 July 2025. Shell attempted to call TLC on 09 September 2025 with no answer. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or objections or claims they may have about the activity. No response has been received. **607. Top End Aboriginal Coastal Alliance (TEACA)** TEACA received sufficient information on 13 December 2024. TEACA guided Shell on which First Nations Consultative		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					Committees (FNCC) should be consulted with for the purposes of this EP. Shell conducted in person, or Teams meetings with each of those First Nations Consultative Committees: • 535. Cobourg FNCC - (Wurrumiyanga) – 27 March 2025 • 535. Cobourg FNCC – (Jabiru) - 03 April 2025 • 610. Djulidki FNCC – 6 November 2024 • 538. Gapu Maringa FNCC – 24 July 2025 • 537. Goulburn Islands FNCC – 29 April 2025 • 533. Jindiwi FNCC – 01 April 2025 • 611. Kardu Lalingkin FNCC -08 November 2025 • 536. Maningrida Regional FNCC – 02 April 2025 • 534. Mulurryud FNCC – 02 April 2025 • 539. Ngoy Garmak FNCC – 22 July 2025 • 609. Rak Badkalarr FNCC – 15 October 2025 • 540. Tiwi Clans FNCC - 26 March 2025 Note, three of the First Nations Consultative Committees were consulted earlier than December due to the logistical difficulties in accessing these locations. This was because consultation was occurring for another EP at that time. The draft EP was shared on 24 September 2025 with a final opportunity to provide input to Shell for EP preparation, clearly restating the purpose of consultation, the request for their input on matters we may not be aware of, such as cultural values or features, or		

Indigenous relevant person	Relevant person's Functions, Interests and Activities	Petroleum activity impacts and risks which may affect relevant persons Functions, Interests, or Activities	Nature and scale of effect on relevant persons Functions, Interests, or Activities	Sufficient Information provided	Consultation overview	Reasonable period provided	Appropriate measures adopted
					objections or claims they may have about the activity.		

Justification that the Regulation 25 obligations and Regulation 34(g) acceptance criteria have been met

Shell has addressed all feedback received from Tier 2 relevant persons and adopted appropriate measures in the EP as required. All Tier 2 relevant persons functions, interests and activities are only potentially impacted by the spill risk from Shell's activities (through dissolved/entrained oil). Any impact to their functions, interests and activities is predicted to be slight. Other than source control options which are already planned to be implemented by Shell in the event of a spill, there are no other available options to directly mitigate or reduce the impacts of dissolved/entrained oil during spills which could occur from this activity. Therefore, further consultation is unlikely to improve risk management or further reduce the environmental impacts of a spill in accordance with the objects of consultation in preparing an EP. For relevant persons who did not respond to requests to provide feedback, Shell then made further attempts by alternate available means to elicit a response up until October 2025. Shell has provided sufficient information to inform these relevant persons how their functions, interests and activities may be affected, made reasonable efforts to consult with all of the relevant persons, provided a reasonable period for them to determine if their functions, interests, and activities may be affected, and to review information and provide feedback to Shell. Shell also adopted appropriate measures based on input from the relevant persons that did respond during consultation. Given the remote likelihood and scale of potential risks to their functions, interests and activities, consultation has been completed in accordance with section 34(g) of the OPGGS(E) Regulations.

5.9 Assessment of Merit of Objections and Claims

Shell's evaluates feedback received during consultation using four broad categories:

- **objection or claim with merit** – the issue raised is directly relevant to both the proposed activity and the relevant person's functions, interests or activities. It is considered to have merit if there is reasonable / scientific basis to suggest that related effects or impacts could occur and/or there is a reasonable basis for the objection or claim to be addressed in the EP.
- **objection or claim without merit** – while the issue may be relevant to the proposed activity or the relevant persons functions, interests, or activities, it lacks a credible or scientific foundation and therefore is not considered to have merit.
- **relevant matter** – the issue raised does not meet the criteria for an objection or claim with or without merit. However, it is still pertinent to the proposed activity, and may include requests for additional information or provides information to Shell that is relevant to the activity or the EP.
- **not a relevant matter** – the issue raised does not relate to the planned activity or the relevant person's functions, interests or activities. This category may include general or administrative communications that do not raise a specific issue.

Appendix B contains Shell's assessment of the feedback received from relevant persons during consultation, the merits of objections or claims, measures adopted, and any changes incorporated into the EP as a result of the feedback.

In compliance with section 26(8) of the OPGGS(E) Regulations, sensitive information (if any) contained in an EP, as well as the full text of any response by a relevant individual to consultation under section 25 of the OPGGS(E) Regulations during the preparation of the EP, must be included in the sensitive information section of the EP and not elsewhere.

5.10 Summary of Consultation for the Environment Plan

Shell considers that consultation will be complete when:

- each relevant person has received sufficient information and reasonable time to assess the impacts of the activity on their functions, interests, or activities and.
- all objections or claims have been discussed and, where reasonably practicable, resolved by Shell.

Appendix B summarises all consultation carried out with relevant persons during the preparation of this EP in accordance with section 25 of the OPGGS(E) Regulations.

5.11 Ongoing Consultation as Part of EP Implementation Strategy

Consistent with section 22(15) of the OPGGS(E) Regulations, Shell will undertake ongoing consultation as part of the EP Implementation Strategy (see Section 10), with the intent to acquire and preserve an up-to-date understanding of relevant persons' functions, interests, and activities during the execution of Shell's proposed activities. Specific ongoing consultation activities Shell has undertaken to carry out are set out in Table 5-13. It should be noted that this is not an exhaustive list of all ongoing consultation activities Shell may undertake in the future.

Ongoing consultation under the Implementation Strategy will enable Shell to maintain relationships with relevant persons and foster a continued improvement in Shell's understanding of the features and values of the existing environment, and where new risks or impacts are identified, the establishment of appropriate controls to reduce risks and/or impacts to ALARP.

Matters raised post-acceptance of the EP will be assessed as detailed in Section 5.8, to confirm if the matter raised is a relevant matter or if objections and claims have merit. Any new risks or impacts that are discovered through ongoing consultation will be subject to Shell's Environment MOC process, which considers the requirements of sections 26, 38 and 39 of the OPGGS(E) Regulations and establishes the mechanisms to assess change to the EP. Section 10.4.4 describes this MOC process in detail. Further ongoing consultation requirements, in the form of notifications of various kinds, are outlined within Sections 10.12.2.2 and 10.12.2.3.

Table 5-13: Ongoing Consultation Program for Prelude

Ongoing Consultation Topic	Relevant Persons	Timing	Nature of Ongoing Consultation
The previously completed Underwater Cultural Heritage report will undertake an independent peer review. Once completed, Shell will use findings as part of Shell's ongoing consultations with Indigenous relevant persons to better understand tangible and intangible Cultural Values and Features within the Activity Area and Planning Area.	Consultation with relevant persons (including Indigenous relevant persons and other organisations) on this topic will occur where they choose to voluntarily participate.	The Underwater Cultural Heritage report has been completed as well as a peer review. It will be shared with relevant Indigenous groups who request further information on its findings over the course of 2025 and 2026.	This ongoing consultation will occur at the express preference of the Indigenous relevant persons concerned. It is anticipated this could be on-Country of the relevant Indigenous persons however other methods of ongoing consultation will be offered.
Industry collaboration on Indigenous People involvement in oil spill preparedness. Given the program is a novel approach, the activity is planned to be a pilot project initially. Shell believes an industry collaboration with involvement from AMOSC (or similar organisation) is the best vehicle to progress this request in a mutually beneficial manner. Shell will seek to work with AMOSC in establishing an industry collaboration and if successful, progress ongoing consultation with traditional owners in the codesign of a suitable training program, with input from WA DTMI, as the control agency for oil spill response within WA state waters.	It is not reasonably practicable to implement a pilot such as this with many Indigenous People. However, Shell acknowledges the importance of ongoing consultation in relation to this matter with Indigenous People. Initially this pilot was offered to Bardi-Jawi people. However, due to competing priorities it has been discussed with other Indigenous People including Nyul Nyul people.	This is a long-term commitment, which is subject to the success of a pilot program. The establishment of this program commenced in 2023. Due to a number of influencing factors which are outside of Shell's control, such as appetite for industry collaboration and DTMI's acceptance of the program (given they are the control agency), a more specific timeframe cannot be committed to. Shell has commenced planning, and initial engagement with Indigenous groups, industry and DTMI (outside of EP section 25 of the OPGGS(E) Regulations consultation requirements) has commenced.	This ongoing consultation will occur through co-design, at the express preference of the specific Indigenous People.

Ongoing Consultation Topic	Relevant Persons	Timing	Nature of Ongoing Consultation
Local Content and supply opportunities were a topic of interest for numerous relevant persons during the community and Traditional Owner consultations. Shell is committed to giving Australian suppliers, local, regional, and Indigenous businesses genuine opportunities to participate in our supply chain. It uses a supplier portal to publish work packages and has dedicated staff resources to support Indigenous business to enter and then remain in Shell's supply chain.	• Bardi Jawi Aboriginal Corporation. • Joombarn-Buru Aboriginal Corporation. • Dambimangari Aboriginal Corporation. • Broome Shire (including Djarindjin community). • Nyamba Buru Yawuru.	Two full time Shell resources are responsible for this remit and will communicate relevant opportunities to the relevant persons as they arise and continue to raise awareness of potential opportunities via emails and phone calls.	Shell will continue to raise awareness of its supplier portal at all consultations. Supplier Information sessions will be held as required in the project support bases based on upcoming project and business demands to encourage local content via discussion of procurement categories and upcoming work tenders.
Shell will carry out ongoing consultations with Indigenous People in the Kimberley, adjacent to the Planning Area for Prelude, outside of this activity scope, to better understand cultural features and values of the environment to better inform current and future impact and risk assessments.		Subject to preferences of each specific group, Shell is aiming to set-up regular meetings with these Indigenous groups.	This consultation will be driven by the preferences of the Indigenous People e.g. cadence and on Country meetings.
Where Indigenous People have identified cultural features and values which may be affected by major spills, Shell has committed to further ongoing consultation with them to better inform an effective response to mitigate the effects of a major spill, inclusive of potential impact to identified cultural features or values.	• Bardi Jawi Aboriginal Corporation. • Walalakoo Aboriginal Corporation. • Mayala Inninalang Aboriginal Corporation. • Wanparta Aboriginal Corporation.	Further consultation will occur in the event of a major spill which threatens the area where identified significant song lines and ceremonial sites occur.	This consultation will be driven by the preferences of the Indigenous People e.g. on Country meetings.

Ongoing Consultation Topic	Relevant Persons	Timing	Nature of Ongoing Consultation
In preparation of this EP, DCCEEW requested that ongoing consultation with the Department's UCH Team occur in relation to activities that have the potential to impact UCH.	DCCEEW UCH Team.	During the execution of the activity, where potential impacts to UCH are established.	This consultation will be driven by the discovery of potential impacts to UCH. To date, through relevant person consultation and the execution of a First Nations UCH Impact Assessment (Cosmos Archaeology 2023) and subsequent peer review, no planned impacts to UCH have been identified. Shell has a chance find process as detailed in Table 9-33, which may trigger this ongoing consultation requirement, should a discovery be made. Additionally, through ongoing consultation with Indigenous persons, if an impact to UCH is established, Shell will consult the DCCEEW UCH Team.

6 Description of the Activity

6.1 Scope of the EP

This Section describes the petroleum activity (or petroleum activities) in accordance with subsection 21(1) of the OPGGS(E) Regulations, also referred to as 'activity' or 'activities' throughout the EP.

For the avoidance of doubt the activity types, as detailed in subsection 59B(1) of the *Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Regulations 2022 (Cth)*, addressed within this EP as required by subsection 21(1) of the OPGGS(E) Regulations include:

- Operation of a facility that is used for the recovery or processing of petroleum
- Significant modification of a facility
- Drilling.

These activities are broadly summarised as operations and maintenance of the Prelude FLNG facility (or facilities), which comprise the infrastructure, equipment and physical descriptions listed in Table 6-1. The physical delineation of the activities is detailed in Figure 6-1.

- Facilities are summarised in Table 6-1 and described in Sections 6.1, 6.2, 6.6, 6.7, 6.8 and 6.9
- Activities are described in Table 6-1 and described in Sections 6.10.

The Crux pipeline and subsea infrastructure, which comprise part of the hydrocarbon system to backflow gas from Prelude FLNG to the Crux platform for use during hot commissioning and start-ups on Crux; and for the production of gas and condensate (and associated constituents) from Crux topsides to Prelude FLNG, is covered under the Crux Completions, Hot Commissioning, Start Up and Operations EP. A 16″ internal diameter (ID) flexible riser terminates the Crux pipeline facility at the upstream flange of the Riser Emergency Shutdown Valve (RESDV) in the Prelude FLNG turret (see Figure 6-2).

Table 6-1: Summary of Facilities Associated with the Activities

Facility/Activity	Summary Description
Subsea infrastructure facilities	• Bend stiffener connectors for both the flexible riser and dynamic umbilical. • 16 mooring lines, piles and a catenary mooring system in the internal turret which provides interface with subsea systems. • A 7 well tie back which consists of 2 x 6 well slot Production Manifolds at the Drill Center DC1-P. • Four 3km flowlines arranged in 2 piggable loops connecting the Production Manifolds to a Riser Base Manifold (RBM), which each incorporate a Fail-Closed Riser Base Valves (FCRBVs) to isolate the facility from the flowlines inventory. From the RBM, four 12" flexible production risers feed the FLNG facility. Each manifold is connected to two flowlines via the manifold jumpers together to provide dual looped flow paths. • A RESDV installed at the top of each riser on board the Prelude FLNG facility, and riser vent gas monitoring provided to monitor diffusion of gas through the pressure sheath into the flexible pipe annulus. • The subsea umbilicals, which supports the subsea system to provide hydraulics, electrical power/comms controls and chemical injection for the wells. Maintenance, replacements, overhauls and equipment modifications of listed subsea infrastructure are included activities.
Wells facilities	Seven wells ~3 km north of Prelude FLNG are part of the hydrocarbon system which are tied back to the facility via four 12" Corrosion Resistant Alloy (CRA) flowlines. Four spare slots are available for potential well re-spudding and contingency. Each well has a Christmas tree arrangement consisting of a Tubing Head Spool mounted on each well head and a recoverable Flow Control Module which houses

Facility/Activity	Summary Description
	assemblies for interconnection. The valves on the flowline side are ROV operable, and the internal manifold to manifold connections can be controlled via the DCS. Prelude is positioned above the seven production wells (designated P1ST1, P3, P4, P5, P6, P7, P8). Each well is connected to Prelude via production manifolds, flowlines and flexible risers and has a subsurface safety valve. Prelude's 8th Well (P2) was permanently isolated from permeable zones, fluids, and pressures using verified plugs after well objectives were not met. All well functions can be controlled remotely from Prelude FLNG. Well maintenance activities within scope of this EP include planned or contingency light well intervention activities. Well workover scopes with a MODU are out of scope.
Substructure facilities	The Prelude substructure is double hulled on each side extending over the full length of the storage tanks. It is separated from the Topsides by the main deck on which piping systems are located, and includes but is not limited to: • Storage Tanks • Aft & Forward (FWD) Machinery Spaces • Marine Facilities (Mooring and Offloading) • Water Intake Risers • Thrusters and ballast systems • Accommodation/Living Quarters • Workshops and offices The following tanks are installed in the substructure: • 8 Water ballast tanks • 6 LNG Storage Tanks • 4 LPG Storage Tanks • 6 Condensate Storage Tanks • 1 Produced Water Tank • 2 Off Spec Tanks. • 2 Rich MEG Tanks + 1 FWD Rich MEG Tank • 2 Lean MEG Tanks • 1 Solvent Storage Tank • 1 Water Wash Storage Tank • 1 Chemical Spills Collection Tank • Slop Tanks • 1 PMR Tank • 1 Ethane Tank • 4 Diesel Storage Tanks

Facility/Activity	Summary Description
Topsides infrastructure facilities	Facility topsides include all systems spanning LNG, Upstream, Storage and Loading and Utilities, with a total estimated peak of 734 MMscf/d of combined gas and condensate. Production rates will vary and may be subject to continuous improvement and optimisation to enable production performance to technical maximum. Crux is expected to contribute a maximum of 550 MMscf/d of total production. See Figure 6-6 for digital representation of Prelude topsides. The topside equipment is arranged in large modules over a series of process decks and consists of the following key components: • Inlet Facilities • Flaring/Venting • NGL Extraction & Fractionation, Booser Compressors • Acid Gas Recovery Unit (AGRU) Absorption Side Gas Dehydration and Mercury Removal • Liquefaction • End Flash, Boil Off and Fuel Gas • AGRU Stripping Side, MEG Injection • Utilities and Steam Generation • Safety Infills, Laydown Areas • Helidecks and Living Quarters

Operations activities	Operations activities include the following and will be continuous through life of field and duration of this EP:
	• Production Operations – Activities to ensure that operations of the facility are conducted within their defined envelopes. This includes the processing of Crux gas on Prelude.
	• Maintenance and Inspection – Activities to inspect and maintain hardware and equipment integrity and reliability, including Turnarounds. Maintenance, replacements, overhauls, and equipment modifications of topsides facilities and connected facilities are included activities.
	• Brownfield modifications – which are part of ensuring the efficient operation of the Prelude FLNG facility over its operating life.
	• Subsea IMR – Activities to inspect, maintain, replace, overhaul, modify and/or repair the subsea facilities.
	• Emergency Response activities
	• Services – Includes the following activities:
	  ○ Maritime and Terminal Operations - activities relating to the management of access and/or movement of marine vessels within the Safety Zone; and the management of product offloading/import activities (only when vessels are attached to Prelude)
	  ○ Helicopter Operations
	  ○ Management of lifting and hoisting and deck services on the facility
	  ○ Facility catering services
	Inspection of the facilities (subsea and pipeline, wells, substructure, topsides) will be conducted in accordance with a risk-based inspection schedule and may occur throughout all activity phases to preserve the safety, reliability, and integrity of the facilities. Planned maintenance is scheduled in the Computerised Maintenance Management System (CMMS).

Logistics and manning activities	Prelude is designed for manning up to 340 POB during all phases of operation. Manning requirements will vary depending on activities and stage of operation and will be supplemented as required by an accommodation support vessel (ASV) or walk to work vessel, during Maintenance Turnarounds. Prelude has two

Facility/Activity	Summary Description
	helidecks and multiple access points for accommodation and vessels, including specific landing areas on the stern and port aft side for motion compensated gangways. Activities will be 24 hours per day, 365 days per year. Vessel-related activities within the Activity Area as defined above will comply with this EP. Vessels supporting the activity when outside the Activity Area (e.g. transiting to and from port) are outside the scope of this EP (except where EP requirements or commitments explicitly apply outside the Activity Area) and must adhere to applicable maritime regulations and other relevant requirements which are not managed under this EP. Simultaneous operations (SIMOPS) may occur between any activities. Timing, duration, and vessel selection for all activities is subject to change due to project schedule requirements, vessel availability, unforeseen circumstances, and weather. During all activities routine and non-routine lifting (e.g. heavy lifting, engineered lifts) and handling of materials and equipment on the topsides will occur (including to, from, and between vessels) using equipment such as the pedestal crane, underhung gantry crane, monorails or davit along with materials handling equipment on the vessels. **Remote operations** When unmanned the Crux platform is designed to be operated remotely from Prelude FLNG. Both Prelude and Crux will be operated according to the Integrated Control and Safeguarding System (ICSS) (manned or unmanned). **Transportation** Helicopters and vessels (such as the Accommodation Support Vessel - ASV, supply vessels, walk to work vessel, support vessels, fast rescue, inspection maintenance and repair (IMR) vessels,) will service the facility for activities such as crew, materials, and equipment transportation (e.g. fuel, supplies, chemicals, parts, waste logistics) in addition to survey, inspection, maintenance, and repair vessels. Remotely operated vehicles, drones and autonomous surface vessels may also be used to perform activities. Personnel access to the facility or ASV vessel will be by helicopter (via Prelude FLNG or Western Australia) or vessel motion compensated gangway. Pilots transfer from the ISV to the FLNG is primarily from the Preludes bow catcher located on Preludes stern with secondary access being at the port and starboard doors. **Well Interventions** Should any well intervention work be required during operations, personnel will be mobilised and equipment operated via a LWI vessel.

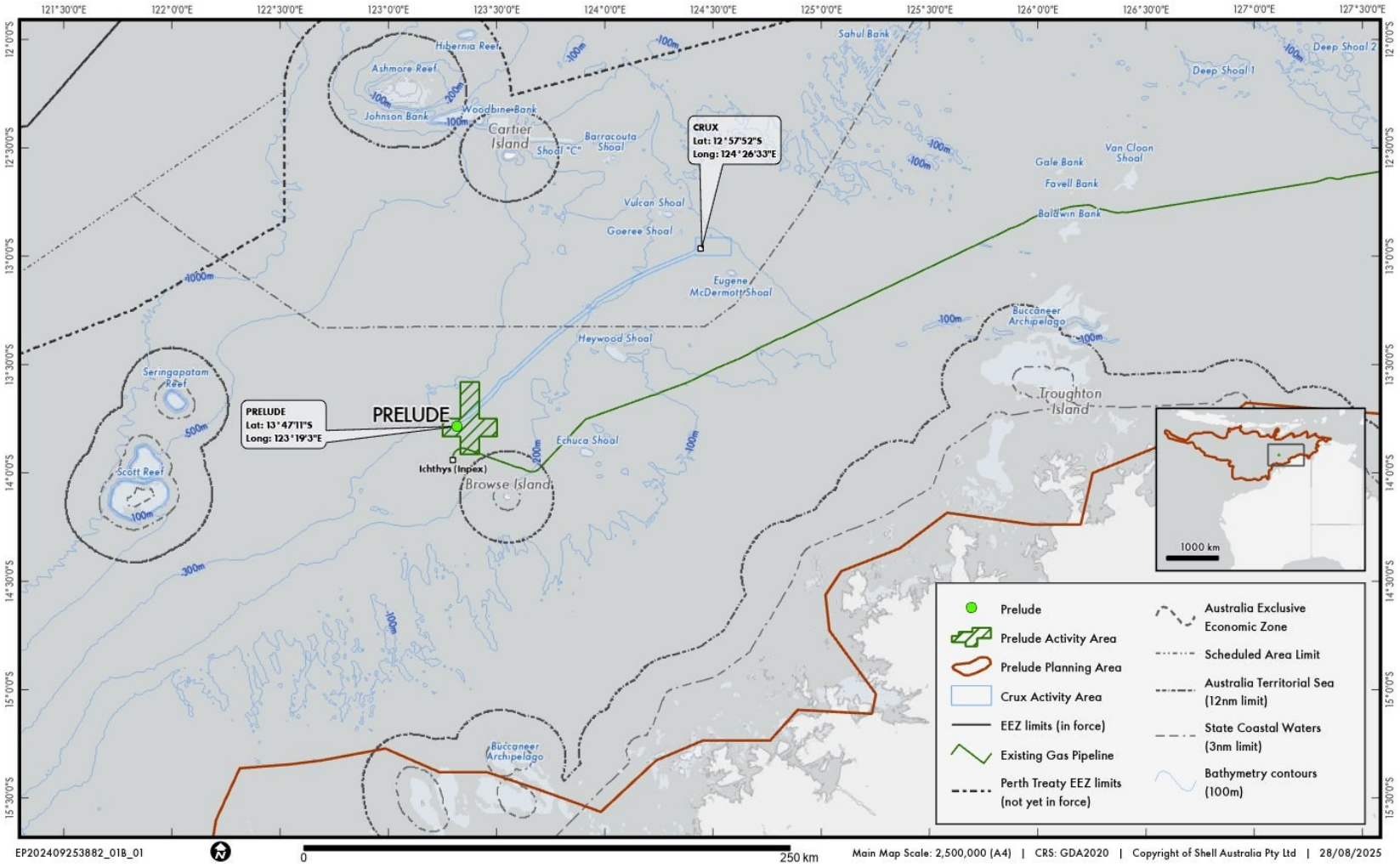


Figure 6-1: Prelude EP Activity Area

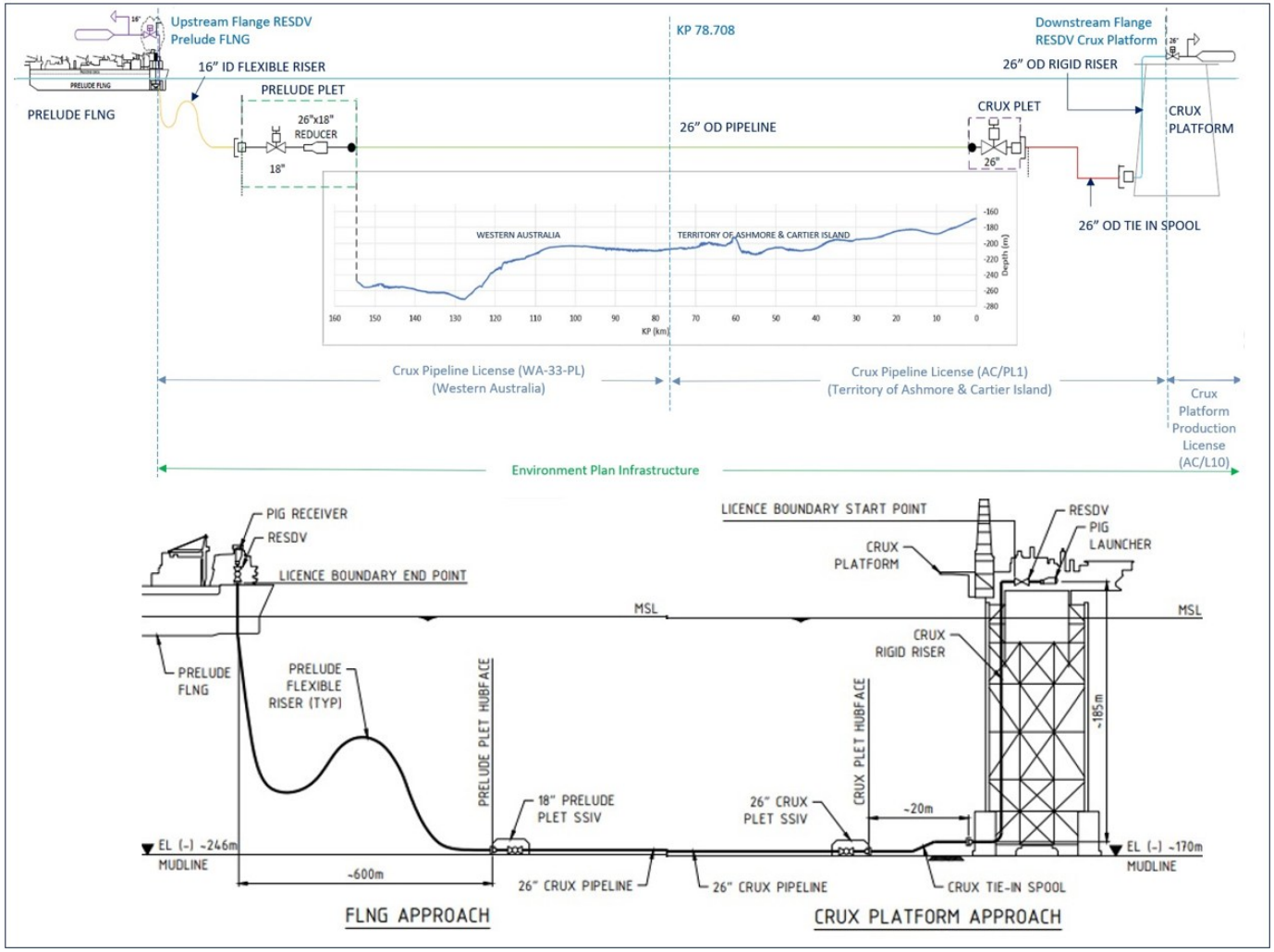


Figure 6-2: Export Pipeline Route Profile, Infrastructure Schematic (Indicative) and Applicable Production and Pipeline Licences)

All numbers and data in this EP are approximate and confirmed only by as built drawings or other reports or calculations, as relevant. Digital image representation is indicative only. Numbers throughout this EP indicated by the prefix '~' or terminology such as 'approximate' or 'approximately' (or similar) are estimates and mostly based on engineering calculations or other reference point. These numbers are intended as approximate numbers and should not be considered precise values.

6.2 Location and Tenure

The Activity Area is defined as the production licence WA-44-L and infrastructure licence WA-2-IL (coordinates and water depths are listed in Table 6-2 and shown in Figure 6-1). The Activity Area is within Commonwealth marine waters, ~220 km offshore northwest Australia and ~475 km north-north east of Broome (Figure 2-1), in 237 m Mean Sea Level (MSL) water depth. Water depths within the Activity Area range from 237 m at Prelude to 298 m within the title area.

The Activity Area does not contain any emergent reefs/islands and does not overlap any Marine Protected Areas (MPAs) such as Australian National Parks (AMPs), with the closest being the Kimberley (~111 km), Cartier Island (~134 km) and Ashmore Reef (~162 km) AMPs. The nearest island is Browse Island, which is ~42 km southeast of the facility. The nearest shoals or banks are the Echuca (~62 km) and Heywood (~84 km) Shoals

The Activity Area includes a 1500 m Petroleum Safety Zone (PSZ) around Prelude FLNG, as well as a 500 m PSZ around Prelude's mooring chain touch down locations and the drill centre (DC-1P) (Commonwealth of Australia Gazette Notice A441884) prohibiting entry from unauthorised marine users.

Table 6-2: Coordinates and Water Depths

Location	Tenure	Water Depth (~m)	Longitude	Latitude
Prelude Production License	WA-44-L	298	13°34'55"S	123°20'04"E
		285	13°34'55"S	123°25'04"E
		254	13°44'55"S	123°25'04"E
		255	13°44'55"S	123°30'04"E
		248	13°49'55"S	123°30'04"E
		240	13°49'55"S	123°25'04"E
		240	13°54'55"S	123°25'04"E
		249	13°54'55"S	123°20'04"E
		240	13°49'55"S	123°20'04"E
		249	13°49'55"S	123°15'04"E
		275	13°54'55"S	123°15'04"E
		260	13°54'55"S	123°20'04"E
Prelude Turret Centre	WA-44-L	237	13°47′11″S	123°19′03″E
Upstream flange (RESDV) on Prelude FLNG	WA-33-PL	N/A	13°47′11″S	123°19′03″E

6.3 Prelude-Crux EP Interfaces

The commencement of this EP, upon regulatory approval, will supersede the existing Prelude EP to cover Prelude Operations and operation of Prelude Modifications for Crux Tie-in (PMCT) infrastructure. PMCT infrastructure will initially be operated on Prelude fluids before transitioning to Crux fluids post Crux RFSU.

This is likely to commence from 2027, following the initial start-up of Crux wells under the Crux Completions, Hot Commissioning, Start-up and Operations EP. The installation of PMCT infrastructure on Prelude is covered under the Crux Installation and Cold Commissioning EP (Figure 6-3).

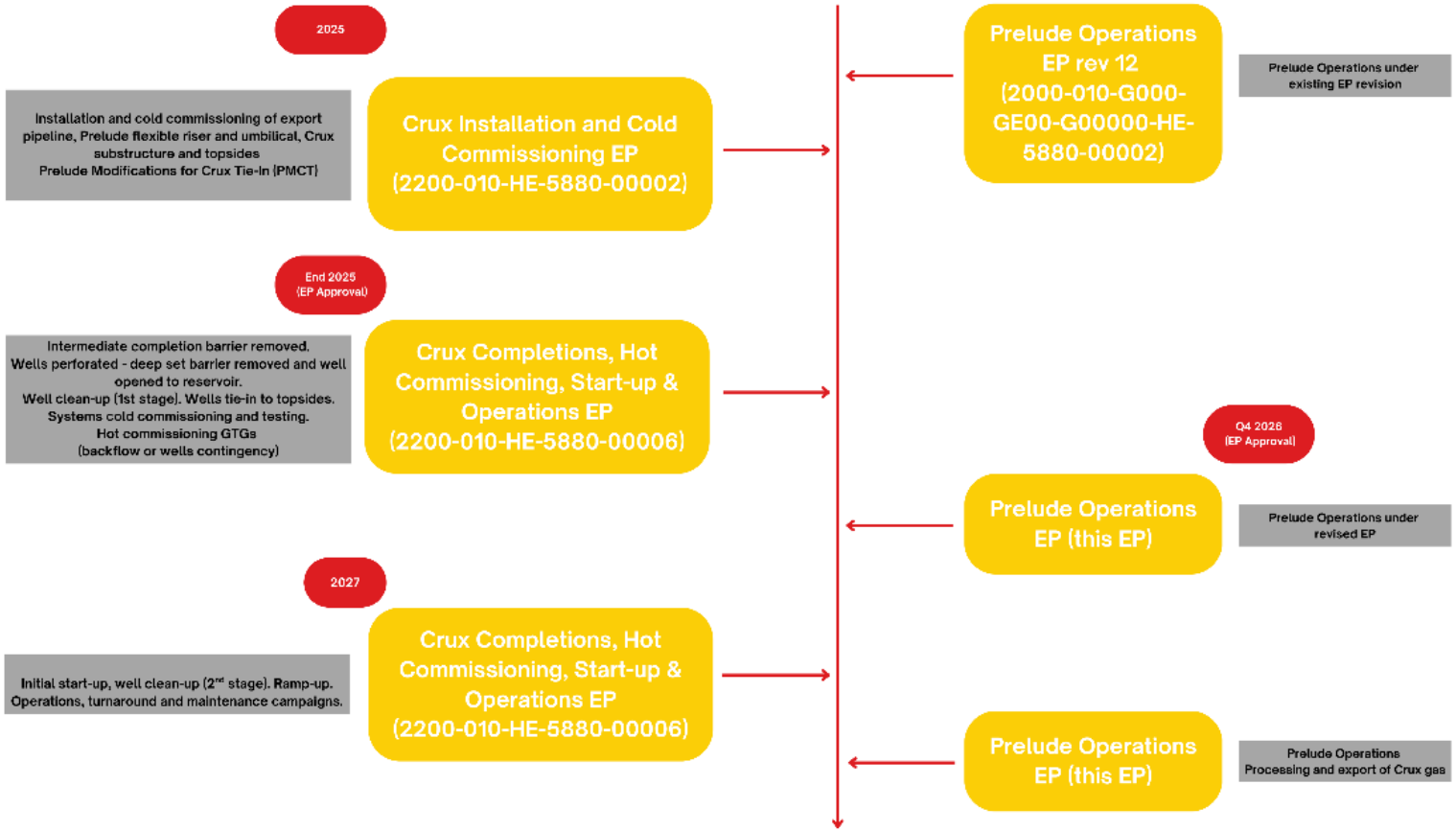


Figure 6-3: Prelude-Crux EP Interfaces

6.4 Duration of Activities

Activities on Prelude will be 24 hours per day, 365 days per year, subject to operational and safety considerations. The production planning (Operating Plan) for the export of hydrocarbons from the Crux platform is currently planned for 15 years, however this is subject to change based on actual reservoir reserves, efficiencies in the recovery of hydrocarbons and the potential for future developments and subsea tiebacks to extend the operating life. The design life of Prelude is 25 years.

6.5 Titleholder and Liaison Person

Table 6-3 lists details of the titleholder, liaison person and arrangements for notifying of changes, in accordance with Section 23 of the OPGGS(E) Regulations.

Table 6-3: Titleholder and Liaison Person Details

Titleholder Details	Liaison Person Details
Company Name: Shell Australia Pty Ltd	Name: Brendan Herbst, Vice President Prelude-Crux
Business address: 562 Wellington St, Perth WA 6000	
Phone: (08) 9338 6600	Phone: (08) 9338 6600
ACN: 14 009 663 576	Email: SDA-preludeflng@shell.com

If the titleholder, titleholder's nominated liaison person, or the contact details change, Shell will notify NOPSEMA (in writing) of the change within two weeks or as soon as practicable.

6.6 Prelude FLNG Facility Overview

The Prelude FLNG facility (Figure 6-4) is a turret moored offshore floating production facility with gas processing and liquefaction units. The facility includes LNG, LPG and condensate storage as well as facilities for exporting these products to offtake carriers. It arrived in field in July 2017, was commissioned and ready for start-up (RFSU) with well hydrocarbon flow commencing December 2018. Prelude FLNG facility has operated in steady state operations since 2022. LNG, LPG and condensate is regularly transferred to offtake tankers.

The following sections describe the facilities outlined in Table 6-1 in more detail.

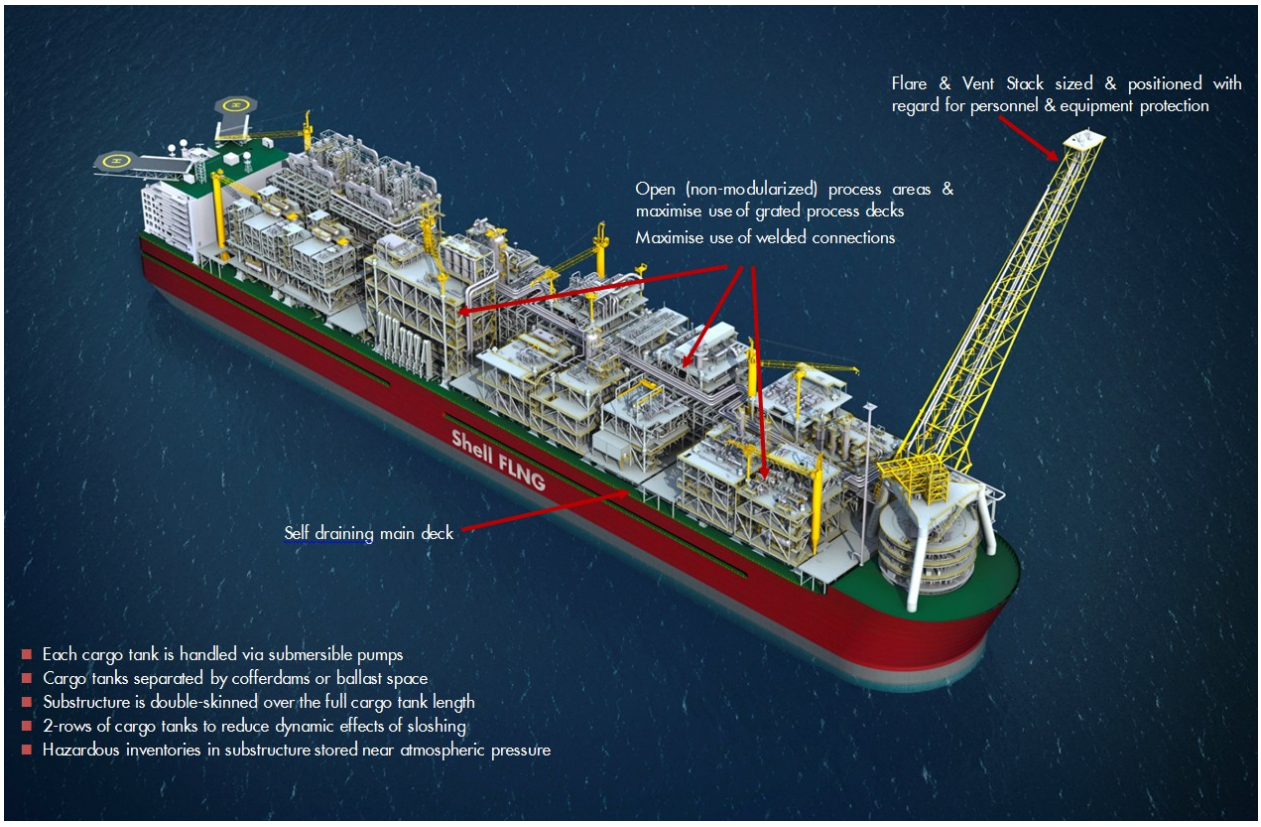


Figure 6-4: Prelude Facility Visual

6.7 Subsea and Wells Facilities

The subsea facilities associated with Prelude comprise of the following main components:

- Seven wells with surface controlled sub-surface safety valves (SCSSV).
- Seven Christmas Trees with control modules, valves, sensors and injection ports.
- Two 6-slot production manifolds providing tie-in for up to 12 wells. Each manifold is connected to two flowlines and manifold jumpers to provide dual looped flow paths.
- Four 12” flexible production risers, connected to the flowlines and the riser base manifold (RBM). A fail close riser base valve (FCRBV) is installed at the RBM for each of the risers to isolate Prelude from the flowline inventory, and a RESDV at the top of each riser onboard Prelude. The riser design accounts for maximum expected H_2S and CO_2 content, and has a vent gas monitoring system to monitor gas diffusion into the flexible pipe steel annulus.
- A dynamic control umbilical providing services, power and communications to the subsea system.
- A wet parking frame, retained at seabed as contingency for intervention work if temporary relocation of equipment is required.
- Sixteen mooring lines linked to catenary mooring system in the turret.
- Prelude P2 abandoned well; permanently isolated from permeable zones, fluids and pressures using verified plugs in accordance with Well Abandonment Manual (WS 38.80.31.35-Gen).

The well manifolds provide 4 spare slots available for potential re-spudding (contingency events). The wells and reservoir are managed in accordance with the Prelude Well Operation Management Plan (WOMP) which is delivered in phases through drilling, completion to production and eventually abandonment under Part 5 of the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration)

Regulations 2011 (Cth). In future a Prelude Abandonment WOMP will be produced, which will describe control measures in place to ensure the risks to the well integrity are reduced to ALARP, including during periods of non-operation, before permanent abandonment.

Permanent downhole equipment includes hydraulically operated SCSSV, production packers, well casing, tubing, cement, mooring piles and mudmat foundation. A SCSSV is installed in each well and designed to reliably shut-in well production (fail safe, below the mud line) if a catastrophic event occurs, allowing operators to maintain safe operations and reduce potential for hydrocarbons loss of containment.

6.8 Substructure Facilities

The Prelude substructure is double hulled on each side extending over the full length of the storage tanks (Figure 6-6). It is separated from the topsides by the main deck on which piping systems are located, and includes but is not limited to:

- Aft & Fwd Machinery Spaces
- Marine Facilities (Mooring and Offloading)
- Water Intake Risers
- Storage Tanks
- Accommodation/Living Quarters
- Electrical equipment rooms, workshops
- Turret Mooring System

The following tanks are installed in the substructure:

- 6 LNG Storage Tanks
- 4 LPG Storage Tanks
- 6 Condensate Storage Tanks
- 1 Produced Water Tank
- 2 Off Spec Tanks.
- 2 Rich MEG Tanks + 1 FWD Rich MEG Tank
- 2 Lean MEG Tanks
- 1 Solvent Storage Tank
- 1 Water Wash Storage Tank
- 1 Chemical Spills Collection Tank
- Slop Tanks
- 1 PMR Tank
- 1 Ethane Tank
- 4 Diesel Storage Tanks

LNG, LPG and Condensate storage tanks are located inboard of segregated ballast tanks covering the full length of the storage area. The tanks are fed directly from the Topsides rundown system.

The port and starboard LNG, LPG and Condensate tanks are separated from each other by a void space or ballast tank. The design of the hull structure is such that LNG, LPG and condensate storage tanks are separated from the plant hazardous area by a main deck which is designed to withstand explosion overpressure, jet fire and cryogenic spills. The LNG, LPG tank tops are double deck type arrangement with all piping systems above the main deck designed to survive blast overpressure load. There are no flange

connections in the piping within the double deck. A heating system is installed to heat the transverse cofferdams and the upper portion of centre line water ballast tanks surrounding the cargo tanks to maintain the temperature of the structure.

The aft machinery space is enclosed within the hull with facilities arranged over 7 decks and are mechanically ventilated. The machinery space is provided with normal access by stairways from the accommodation and the main deck. An enclosed mechanically ventilated space is located in the forward part of the Prelude FLNG facility to accommodate equipment associated with the turret and effluent treatment operation.

The Prelude FLNG facility uses cold cooling water to increase the efficiency of the liquefaction process efficiency and reduce plot space. Water is required to be pumped from an average water depth of 170 m to meet the closed cooling water circuit temperature requirements.

6.9 Topside Facilities

The topsides, fixed to the substructure, consists of the turret and a series of modules supporting utilities and all processing equipment.

6.9.1 Hydrocarbon Process Description

Prelude topside equipment operates to produce hydrocarbons in the form of LNG, LPG and condensate, and consist of the following key functional components:

- Turret and production swivels receiving feed gas from the Prelude-Crux fields for processing.
- Bulk liquids and gas separation to divert each phase off for separate processing.
- Gas treatment, including acid gas and mercury removal, and molecular sieve dehydration.
- Condensate stabilizer, NGL extraction, fractionation and liquefaction units to process fluids to product spec, including the removal of heavier components and cooling for storage and offloading.

Some of the key functional components of the topsides that support the hydrocarbon process includes:

- Steam Turbine Generators (STG) for power generation for all topsides electricity users.
- Fuel gas package for conditioning, scrubbing, and heating fuel gas for fuelling the STGs and distributing blanket, purge, pilot, stripping and flotation gas.
- Black start essential diesel generators (EDG) to provide power to start-up the topsides from a depressurised state.
- Low-pressure and high-pressure flare system to safely dispose of hydrocarbons that cannot be exported.
- Produced water treatment system to remove dispersed oil from separated condensed and formation water.
- Segregated drains system and open drain separator to remove dispersed oil for drain water emanating from potentially hydrocarbon contaminated areas.
- Chemical injection system to manage materials integrity, flow assurance and oil in water separation, as required.
- Diesel, service water, nitrogen, and propane utility systems.

6.9.2 Layout

The process units and other key utility units are located above the main deck in the form of modules, collectively called the topsides. The process and utility units on the topsides are split-up in 8 modules, further sub-divided into 14 sub-modules, 8 infill areas, lay-down areas, hull pipe rack with maintenance route, and 1 flare tower including the marine and CO_2 vent. Figure 6-6 shows a plan view of Prelude FLNG facility detailing the location of the process and utility sub-modules and the key equipment contained per sub-module. The living quarters

and helidecks, including the Central Control Room and the laboratory, are located at the stern, aft of the protective Blast Wall.

The process fluid from the wells passes through the turret module to the processing module on the topsides. The key function and equipment per modules are described below:

- **Module 1S (1S1, 1S3)** contains the inlet facilities and primarily separates the well stream into gas and liquid flows. This unit receives and conditions the feed gas and liquid hence located close to the turret area. Module 1S3 includes installed depletion compressor and its auxiliaries. Units in these modules will function slightly differently with the tie-in of Crux fluids depending on the production mode of the facility.
- **Module 2S1** contains the acid gas recovery unit (AGRU) absorption column, gas dehydration (mole sieve dryers) & mercury removal (Hg guard bed) units. The regeneration facilities for the acid gas removal unit are located in module 3P1.
- **Module 1P (1P1, 1P2)** contains the NGL extraction, fractionation and booster compression units. Because of the amount of light liquid hydrocarbons (C2, C3, C4) and lower integration requirement with other units, the fractionation unit is located as far from the accommodation block as possible. For the same reason, this unit is located in the opposite side of the mooring location of the LNG/LPG carrier (when alongside). The condensers and accumulators are located on an elevated level to provide sufficient net positive suction head (NPSH) for the pumps. All pumps are currently located underneath these vessels at the lowest level in the module.
- **Module 2P (2P1, 2P2, 2P3)** contains the liquefaction unit. The mixed refrigerant (MR) part in module 2P1 consists of the main cryogenic heat exchanger (MCHE) and condensing steam turbine driven MR compressor with its coolers and knockout facilities. The pre-cool mixed refrigerant (PMR) part in module 2P3 consists of the condensing steam turbine driven PMR compressor with its de-superheaters and condensers and knockout facilities. The PMR receiver and main pre-cooler (LP, MP, HP) i.e. coil wound heat exchangers are located in module 2P2 in between the MR and PMR part.
- **Module 3P (3P1, 3P2)** contains the AGRU stripping section and MEG injection unit. The 3P1 module contains the solvent regeneration column, LP steam heated re-boilers, heat exchangers, filters and pumps. The solvent drain vessel is located on the main deck under 2S1 and solvent storage tanks are located in the hull. Module 3P2 contains the MEG injection unit, nitrogen booster compressor and high-pressure nitrogen vessel. The nitrogen booster compressor only operates to top-up the high-pressure nitrogen vessel.
- **Module 3S1** contains the end-flash unit. This module contains the end flash vessel and associated end flash compressor. The fuel gas system with fuel gas heaters is located on an elevated deck. This module also contains the offloading analyser and metering stations. The side-by-side offloading loading arms and associated manifolds are located at main deck level. This module also contains the electrochlorination unit (ECU) and Closed Cooling Water 2(CCW) expansion vessel on the top deck.
- **Module 4P (4P1, 4P2)** contains seven marine steam boilers.
- **Module 4S1** contains the low pressure nitrogen generation unit, de-aerators, CCW2/3 expansion vessel, air compressor. These relatively low risk units (i.e. 4P and 4S) are located in the area between the accommodation and the process area.

The flare boom length is 155 m, inclined by 40° portside perpendicular to the hull. The flare knock out vessels and associated equipment are located adjacent to the flare stack structure in module FLM0.

6.9.3 Wells, Chokes and Production Manifold

The seven production wells are each connected to a Christmas tree, which then connects to Prelude via a system of production manifolds, flowlines and risers. The fluid flow from the wells is controlled via motor actuated choke valves and flow controllers that can be remotely controlled. These controllers take their measured variables from individual gas venturi flowmeters on each flowline and include a water cut meter to detect formation water breakthrough. The flow from the wells is comingled in the production manifold prior to being routed to the facility. A SCSSV is installed in each well and is designed to reliably shut-in well production

(fail safe, below the mud line) if a catastrophic event occurs, allowing operators to maintain safe operations and reduce potential for hydrocarbons loss of containment. A Hydraulic Well Control Unit provides the hydraulic power for opening of the well valves.

The flow of gas from each of the seven wells is controlled via dedicated electrically operated production choke valves. The choke valves also control the pressure to the inlet facilities by reducing the well fluids arrival pressure to the processing system operating pressure. The choke valves are controlled from the Distributed Control System (DCS).

Monoethylene glycol (MEG) injection is required for hydrate inhibition and for pressure equalisation for opening the wellhead production wing valves, and the export header valve. A wet gas venturi meter is installed to provide continuous gas flow measurements and includes a water cut meter to detect formation water breakthrough.

6.9.4 Turret Mooring System

The Turret Mooring System (TMS) is a major element that provides the station keeping function for the Prelude FLNG facility and connects the subsea infrastructure with the topsides process modules. The Prelude FLNG facility rotates freely about the turret subject to the influences of the prevailing winds, waves and currents, naturally adopting a heading (termed weathervaning). This weathervaning requires the use of a swivel stack to transfer the production stream, chemicals, power, and communications signals between the Prelude FLNG facility and the subsea equipment.

The Prelude FLNG facility is permanently moored and designed for cyclonic conditions offshore NW Australia. The mooring system is designed to withstand the design 10,000 years return period cyclone event when all lines are intact. In conditions, up to and including the 100 years return period cyclone, the mooring system offers redundancy following failure of any one mooring line, such that in any principal loading condition will not lead to progressive failure of the mooring system or exceed riser design limits. The turret, shown in Figure 6-5, is an internal type turret and is located completely within the boundary of the substructure at the bow of the facility. All risers and mooring lines pass through the centre of the turret. This design enables mooring chains and risers to be protected from ship collision and direct wave actions.

Modifications have been installed in the turret as part of PMCT under the Crux Installation and Cold Commissioning EP (Section 6.3) to utilise additional slots for riser and umbilical tie in for the processing of Crux fluids, outlined in Section 6.9.5.

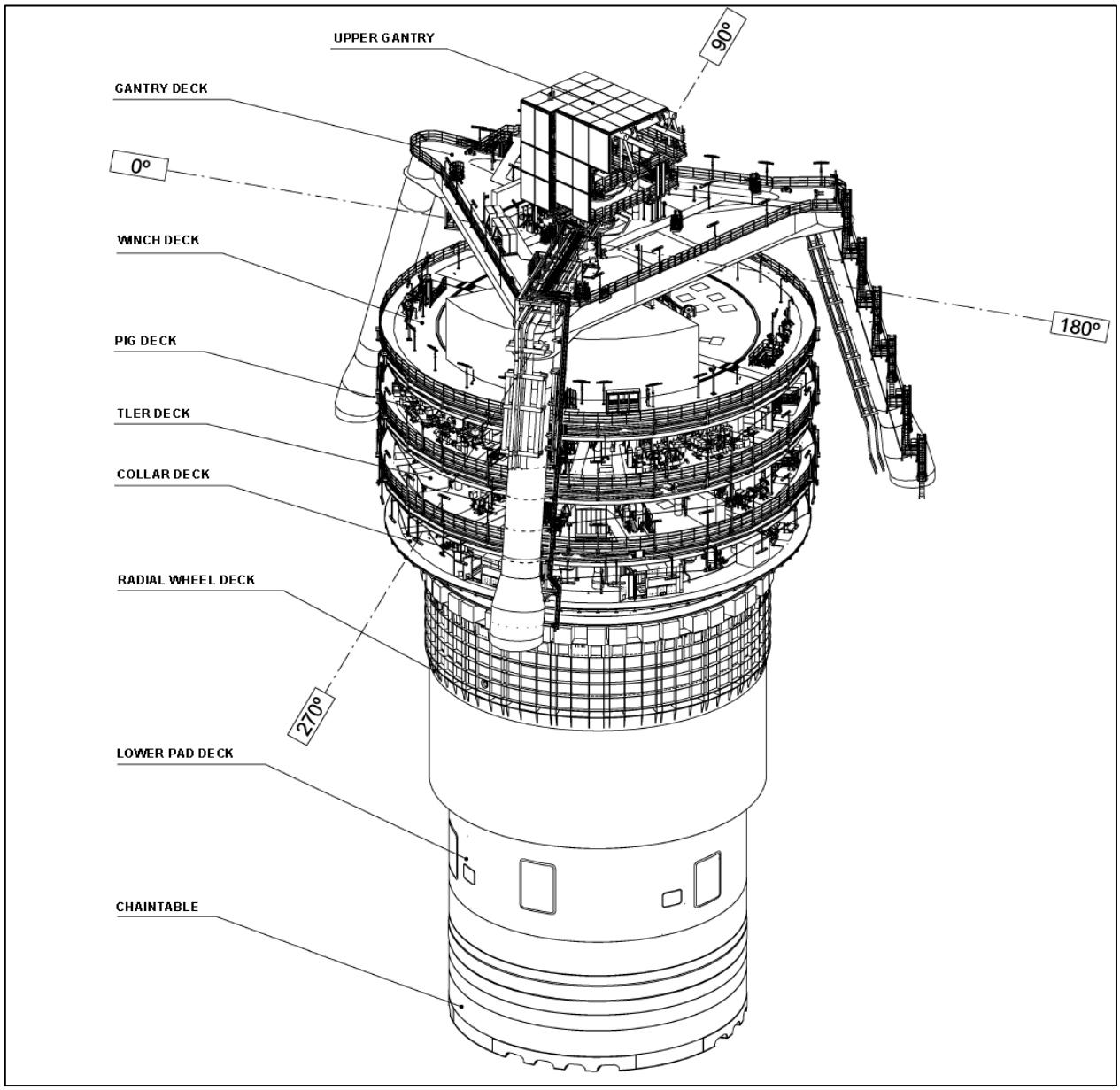
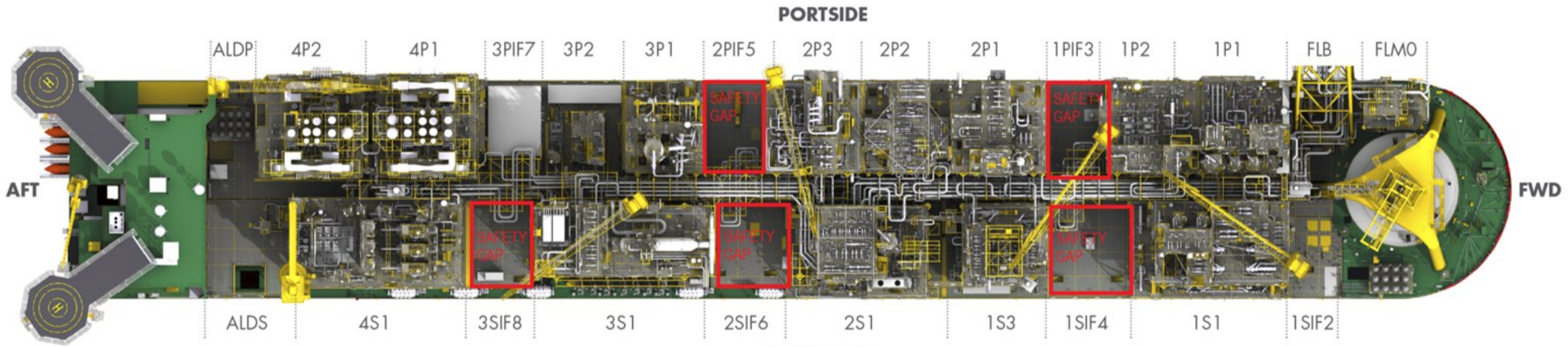


Figure 6-5: Turret 3D View

Module, Process Deck A and above					
Infills (PIF) and Laydown Area	**4P1, 4P2 Steam Generation**	**3P1, 3P2 AGRU Stripping Side, MEG Regen and Reclaim**	**2P1, 2P2, 2P3 Liquefaction**	**1P1, 1P2 NGL Extraction and Fractionation, Booster Compressors**	**FLM0, FLB Flare Module, Flare Stack**
• 1PIF3 (Safety Gap) • 2PIF5 (Safety Gap) • 3PIF7 (LER) • Aft Laydown Portside – ALDP	• Steam Generation (U40000) • 4P1 – Marine Steam Boilers 1-4 • 4P2 – Marine Steam Boilers 5-7 • HP-LP PRS, Distribution • Boiler Blowdown vessels (U41000)	• 3P1 – AGRU (U11000), Solvent Regeneration and Filtration • 3P1 – LP PCL Flash Vessel and Pumps (U41000) • 3P2 – MEG Injection (U52000), High Pressure N_2 Compressor (U48000)	• Liquefaction Unit (U14000), 2P1 – NG Main Cryogenic Exchanger, MR compressor, 2P2 – PMR Reclaimer, NG Pre-Coolers (HP, MP, LP), 2P3 – PMR Compressor • 2P2 – LNG vaporiser & Pump, Maintenance Compresser (U34000)	• 1P1 – NGL Extraction (U14000) NGL extraction column • 1P1 – Fractionation (U15000), De-Ethaniser, De-Propaniser, De-Butaniser • 1P1 – LP PCH Flash Vessel and Pumps (U41000) • 1P2 – NG Expander/ Re-compressor, NG Booster Compressor, Defrost gas heater (U14000)	• FLM0 – Flare Module contains the flare KO drums, stabilizer vessels (U63000) • FLB – Flare stack including marine and CO_2 Vents
Main Deck to Process Deck A (below each Module)					
	• Condensate offloading pumps • Open Non-hazardous drain vessel	• Butane offloading pump hatch • Open hazardous drain vessel and pumps	• LNG Offloading pump hatch • Propane offloading pump hatch	• CO_2 snuffing Skid • LP PCH transfer pumps • LNG Offloading pump hatch	• Wet Stabilizer Vessel • Ethane Refrigerant pump hatch • Propane/PMR Refrigerant pump hatch • Off-spec reprocessing pumps



Module, Process Deck A and above				
Infills (SIF) and Laydown Area	**4S1 Utilities**	**3S1 End Flash, Boil Off and Fuel Gas**	**2S1, 1S3 AGRU Absorption Side Gas Dehydration and Hg Removal, Inlet Facilities**	**1S1, 1S3 Inlet Facilities**
• 1SIF2 • 1SIF4 (Safety Gap) • 2SIF6 (Safety Gap) • 3SIF8 (Safety Gap) • Aft Laydown Starboard – ALDS	• Service/Portable and Demin Water (U-43000), De-aerators • CCW2 Circulation Pumps (U45000) • CCW3 Expansion Vessels (U45000) • Air Compressor, IA generation (U47000) • N_2 Generation Unit (U48000)	• Liquefaction Unit (U14000), LNG Expander, End Flash Column and Compressor • Fuel Gas System (U44000) • CCW2 Expansion Vessel (U-45000) • Electrochlorination unit (U46000) • Propane/Butane metering (U35000) • Condensate metering (U36000)	• AGRU (U11000), Absorption Section • Molecular Sieve Dehydration Unit (U13000) • Mercury Removal Unit (U13500) • HP PCL Flash Vessel (U41000)	• 1S1, 1S3 – Inlet Facility (U10000) • HP Separators, LP Separator, Depletion Compressor, Condensate Stabilizer 1&2, Condensate Stabilizer Overhead compressor • Produced Water Flash Gas package (U64000) • LER • Flare Maintenance Vent (U63000)
Main Deck to Process Deck A (below each Module)				
	• Condensate offloading pumps	• LPG/LNG offloading arms (U34000/ U35000) • Propane/Butane offloading pump hatches • Rich MEG transfer pump	• LNG Offloading pump hatches • Open hazardous drain vessel and pumps • Solvent Drain Vessel	• FWD rich MEG storage tank transfer pump • PW flash gas vessel pump and slop oil pump • Open hazardous drain vessel and pumps • PW flash gas vessel

Figure 6-6: Main Deck and Topsides Layout Plan

6.9.5 Gas Process Facilities

The facility is capable of operating in Crux-only, Prelude-only, or simultaneous production modes, with simultaneous operation expected to be the steady-state configuration. Feed from the turret enters the feed gas receiving and condensate stabilisation system (Unit 10000). In the current Prelude-only facility configuration, the gas, condensate and water phases are separated in two trains of inlet HP separators and one low pressure separator. The separated field condensate is stabilized in the condensate stabilizer and sent to condensate storage (Unit 33000), while the separated gas is routed to the Acid Gas Removal Unit (AGRU, Unit 11000). In simultaneous production mode, gas, condensate, and water phases are separated across two inlet trains: HP Separator V-10011 processes Crux fluids, and HP Separator V-10021 processes Prelude fluids, with a shared low-pressure separator downstream (Figure 6-7).

Dehydrated Crux fluids arrive at Prelude FLNG at seabed temperature and usually without free water, via the Crux export pipeline and flexible riser, entering the turret through a dedicated Crux riser choke valve. These fluids are routed to HP Separator V-10011 via Production Header 1 and Production Swivel 1. Prelude fluids continue to be routed to HP Separator V-10021 via Production Header 2 and Production Swivel 2. The fluids remain segregated until Crux fluids are heated downstream to prevent hydrate formation.

The aqueous phase from Prelude fluids is routed to the water treatment system (Unit 64000). Crux fluids do not contain free water, but HP Separator V-10011 operates in two-phase mode to manage potential hydrocarbon liquid slugs during Crux pipeline start-up. The separator's liquid handling capacity accommodates these slugs by allocating volume to hydrocarbon condensate.

After heating, Crux and Prelude gas streams are combined at the Acid Gas Removal Feed Separator V-10006 (in HP mode) or within the Depletion Compression system (in LP mode), with temperature control ensuring optimal feed conditions (30–33°C) to the Acid Gas Removal Unit (Unit 11000). Similarly, Crux and Prelude liquids are combined upstream of LP Separator V-10012, with temperature control maintained between 40–65°C.

The production modes can be switched between Prelude and Crux modes through a partial facility shutdown to change out spools and configure required isolations. In a Crux-only operating mode, the train processing Prelude fluids would be shut down whilst the Crux train would continue to operate under the same process flow.

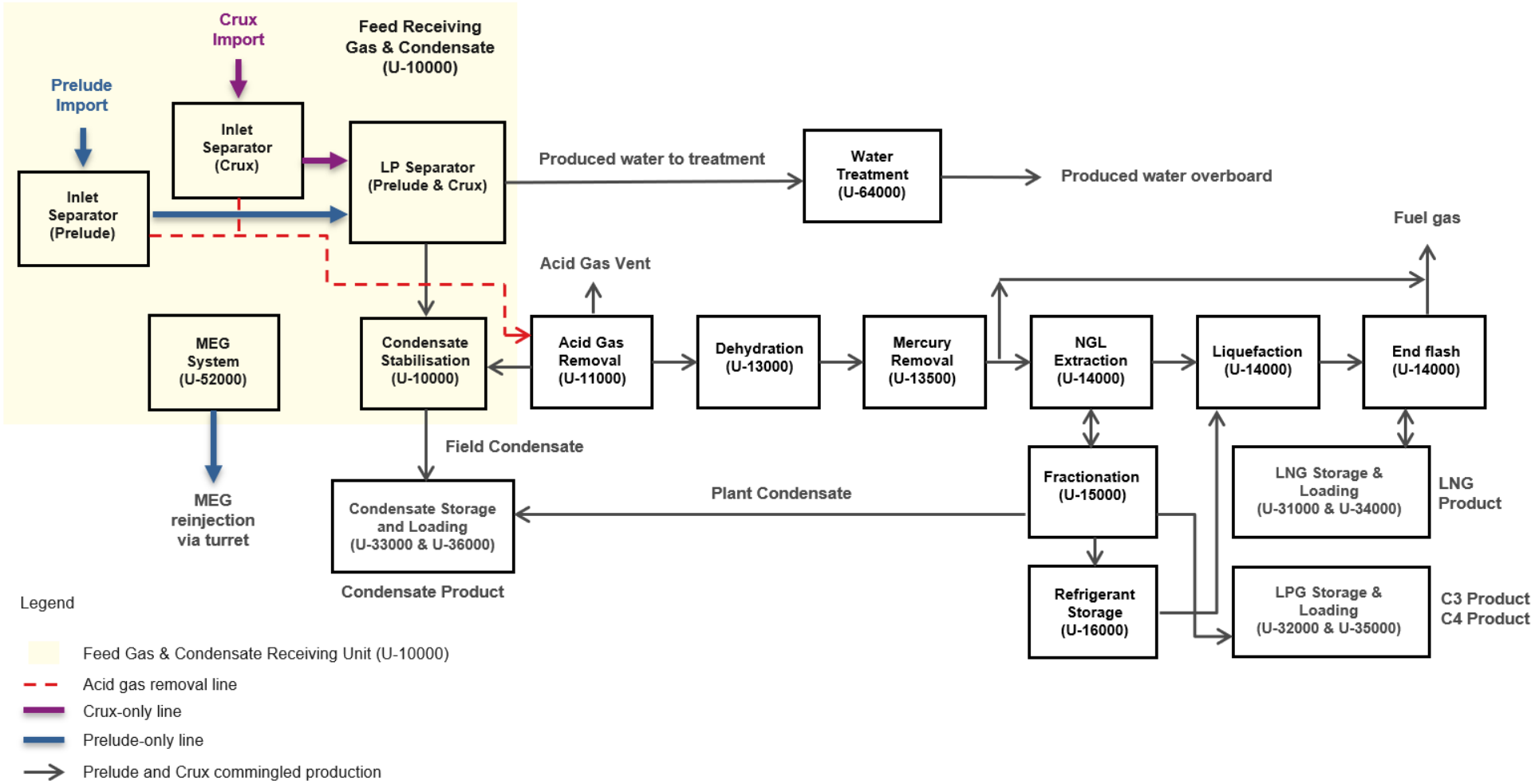


Figure 6-7: FLNG Process Unit Block Diagram

The AGRU removes the acid gases (CO_2, traces of H_2S and mercaptans) from the feed gas by contact with a lean amine based solvent stream. The resulting rich amine is then regenerated and the separated CO_2 rich acid gas stream is routed to the AGRU vent for safe venting. The sweet gas passes through the molecular sieve dehydration (Unit 13000) unit for removal of moisture followed by the Mercury Removal Unit (Unit 13500) unit for removal of elemental mercury. These steps avoid ice and hydrate formation downstream, and prevents rapid corrosion of aluminium equipment. Dried gas flows through the guard bed, where mercury is adsorbed by a metal sulfide-based catalyst. A dust filter downstream prevents carryover of any dust and minimizes blockage or erosion risks in the next process unit. The sweet, dry and impurity free gas then enters Unit 14000 consists of NGL extraction, liquefaction and end flash.

Natural Gas Liquid (NGL) within the feed gas stream is separated in the NGL extraction column. The separated NGL is routed to Unit 15000, fractionation, and the natural gas is sent to the liquefaction section of Unit 14000. The natural gas is pre-cooled and then liquefied using closed loops of pre-cooled mixed refrigerant (PMR) and mixed refrigerant (MR). The produced LNG is let down to close to atmospheric pressure in a turbo expander, before being routed to an end flash column. The resulting atmospheric LNG stream is gravity rundown to storage in Unit 31000 and the end-flash gas produced is compressed for use as fuel gas (Unit 44000).

Within the fractionation Unit 15000, the NGL is separated into ethane, propane, butane and condensate streams. The ethane stream is either: re-injected into the liquefaction unit, routed as vapour for use as fuel gas, or stored in refrigerant storage tank in Unit 16000 as a make-up to the refrigerant loop. Commercial grade propane and butane are produced and routed to LPG storage in Unit 32000. Provision is made to re-inject LPG to liquefaction unit as required. Pure Propane is stored in dedicated refrigerant storage tank in Unit 16000 as a make-up to the refrigerant loop. The plant condensate stream produced from the fractionation unit (U15000) is combined with the field condensate from Unit 10000 and routed to condensate storage Unit 33000. LNG and LPG products are offloaded to ship tankers by side by side offloading in Unit 34000 and 35000, whereas the produced stabilized condensate is offloaded tandem to the condensate tanker by using hose reel in Unit 36000. The majority of the process facilities are located on the topsides, with some facilities such as tank storages and loading pumps located within the substructure.

6.9.6 Produced Water Treatment System

The Produced Water Treatment System (U64000) is divided into three main sections, each with different objectives:

- Degassing section
- Hydrocarbon extraction section via Macro Porous Polymer Extraction (MPPE)
- Disposal section.

The inlet facilities U10000 receive produced water (PW) from production wells. This PW along with other contaminated streams from other units is routed to U64000, on either a continuous or intermittent basis. Details of each of the sources to the U64000 is provided in Table 6-4 and an overview of the process flow is provided in Figure 6-8.

Table 6-4: Sources to U64000

Source	Timing	Condition
Produced water from LP separators (Produced water from wells)	Continuous	Water is produced from the reservoir continuously with gas and condensate. In addition to produced water from wells, the aqueous phase from LP separator can also intermittently include Lean MEG from subsea or topsides injection activities, or from reprocessing activities from off-spec condensate tanks T-10001A/B. The Lean MEG is comprised of pure MEG and Normally Clean Condensate (NCC) prior to injection. This will occur several times per year.

Source	Timing	Condition
		Utility Water may also be intermittently present in the aqueous phases from the LP Separator post major maintenance activities such as turnarounds and tank Confined Space Entry (CSE) inspections.
Condensed stabiliser draw vessel (Produced water from wells or boiler feed water)	Intermittent/ Continuous	Produced water from the wells can accumulate in the water side draw of the condensate stabilisers and is intermittently drained to U64000. This may increase to continuous if the water fraction in the feed to the stabilisers increases over time with changing produced water chemistry. There is provision to inject boiler feed water (BFW) into the condensate stabilisers to clean the stabiliser internals and reboilers from fouling due to entrained salts from produced water, which may increase over time with changing produced water chemistry. The BFW is drawn off into the stabiliser side draw vessel and then routed to U64000.
Water from sand handling package (A-10010)	Intermittent	During sand sparging of the LP separator, NCC is directed to U64000. Sand sparing occurs usually less than once per year on an as-needed basis for solids identification.
Wash water bleed from AGRU solvent regeneration reflux pumps	Intermittent	This stream can contain Activated Methyl Diethanolamine (aMDEA) from the AGRU solvent. The design intent is to provide a path to bleed-off water content in the AGRU solvent to correct the composition. This would only occur if the AGRU tanks are out of service and composition correction is required. To date this line has never been directed to U64000 and is unlikely to be required.
Dehydration unit regeneration water (U-13000)	Intermittent	Stream is mostly comprised of water from the AGRU solvent circuit (NCC), and some aMDEA. Diverted to U64000 after Molecular Sieve Change-out every 4 years to purge Total Suspended Solids (TSS) to prevent accumulation in AGRU solvent and foaming. The stream is also diverted when solvent drain drum V-11005 is out of service for any reason, which is expected to occur once per year or less. Diversion of this stream to U64000 requires DCS supervisor login (i.e. Offshore Area Team Lead).
Contaminated steam condensate from PCL and PCH collection headers (U-41000)	Intermittent	Potentially Contaminated condensate with Light Hydrocarbons (PCL) and Heavy Hydrocarbons (PCH) streams are diverted to U64000 on an approximately monthly basis. Reasons for diversion include maintenance, suspected or potential hydrocarbon contamination, or as a pre-emptive measure during transient events such as start-up and shutdown.
Clean Slop tank	Intermittent	There is provision in design to route contaminated water from Clean Slops tanks via the condensate transfer header to U4600 for treatment if required.
Emulsion Breaker A-50010A	Intermittent	There is provision in design to inject emulsion breaker to improve separation of oil and water for the purpose of meeting oil-in-water specifications at the MPPE outlet. This has not been used for Prelude before, but may become required intermittently upon Crux start-up or with changing produced water chemistry over time.

Source	Timing	Condition
Condensed Steam from MPPE Regeneration	Intermittent	Low Pressure Steam is used to regenerate the MPPE media as part of the MPPE sequence (pre-heat and regeneration steps). The condensed steam is collected in the MPPE separator and buffer tank, then recycled back to the MPPE inlet where it is combined with the produced water, treated via the MPPE, and ultimately directed overboard.
Aqueous Phase from Closed Drains	Intermittent	The closed drain system is designed to dispose of liquids from hydrocarbon-containing systems for operational purposes (e.g. analyser sample stream discharge), maintenance (e.g. draining prior to intrusive maintenance), entrained liquid from flared streams or emergency liquid relief. Some sources to the closed drain system are 'wet' and hence have an aqueous phase. The inventory of the closed drain is intermittently emptied to the off-spec condensate tanks, T-10001A/B. The contents of T-10001A/B are intermittently reprocessed via the LP separator, and any aqueous phase from the closed drain will hence ultimately be directed to U64000.

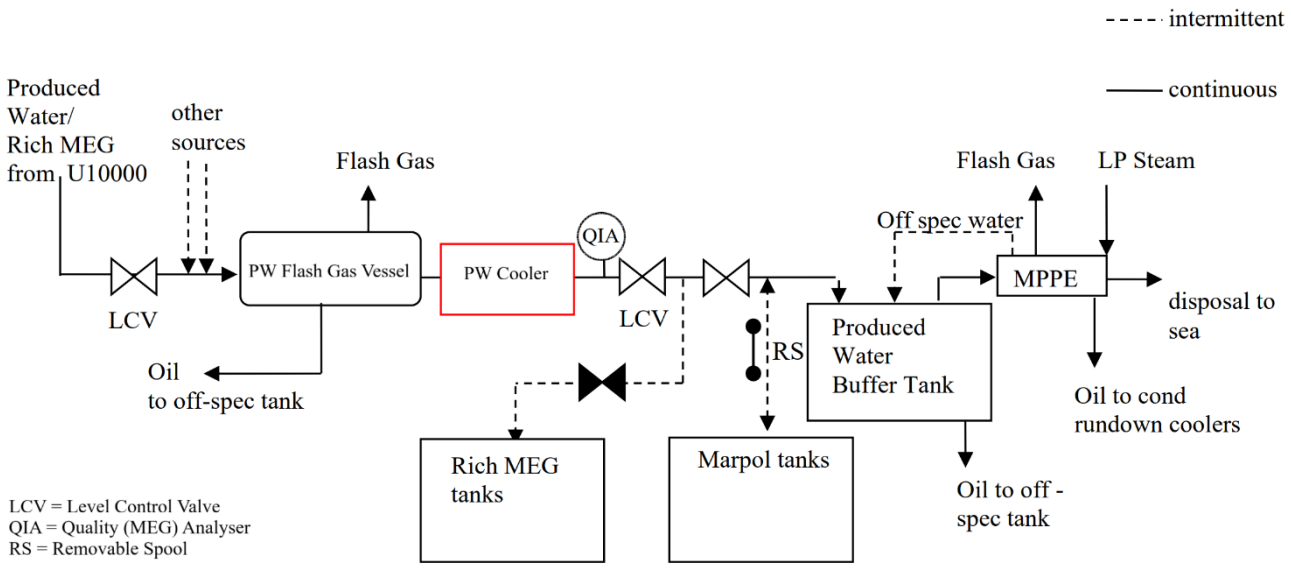


Figure 6-8: Produced Water Treatment System Process Flow

The degassing section refers to the section between the produced water inlet and produced water buffer tank. This first section collects produced water and other effluents from several sources and achieves degassing, primary hydrocarbon removal and cooling. It includes the Produced Water Flash Gas Vessel (V-64031) in Package A-64030, Produced Water Cooler (E-64001A/B/C) and Produced Water Buffer Tank (T-64001). The inlet produced water streams are first routed to a water flash gas vessel where the pressure is reduced to the LP wet flare operating pressure. This degasses the dissolved hydrocarbon in the produced water inlet streams. Skimmed oil is sent to off-spec tanks (T-10001A/B) for further re-processing. The degassed stream is then cooled to 34ºC by the produced water cooler; this is the optimum temperature for efficiency of the downstream MPPE.

Pumps from the produced water buffer tank transfer water with traces of hydrocarbon to the MPPE package (A-64010). The MPPE package, which is designed to remove dispersed and dissolved hydrocarbons from the water, consists of four columns (two in service: one in extraction mode and one in regeneration mode, and two in stand-by) containing a packed bed of macro porous polymer extraction material which is oleophilic and hydrophobic. Two spared columns located within the package allow for the change-out of the extraction

columns for onshore regeneration. Each column will have its installed spared column with a set of manual valves to allow operator manual change over. When MPPE is unavailable, produced water can be diverted to the MARPOL system temporarily via a removable spool if required.

The system can also receive off-spec water from Clean Slop tanks via the produced water buffer tank. Clean water from the Slop Tanks is normally discharged overboard to sea while monitoring oil in water content, however, in case concentrations exceed specified discharge limits, the overboard discharge is ceased, and oily water is routed to the produced water buffer tank after recycling within the slop tanks. Similarly, the MPPE treated produced water can be recycled for further processing to within discharge limits.

During the column regeneration phase, very low pressure steam is used to evaporate the components from the macro porous polymer extraction material, resulting in a vapour flow of mixed hydrocarbons and steam. The vapour is routed through a condenser where condensation of both steam and hydrocarbons takes place by cooling with closed loop cooling water (CCW3). The extracted hydrocarbon (BTEX rich) as a by-product is collected in the overhead vessel, which is pumped back to the hydrocarbon condensate streams at the upstream of rundown cooler in U10000.

A new online oil-in-water analyser (Inov8 EXS) monitors the oil concentration of the produced water to be discharged overboard with high alarms connected to the DCS. A flow meter is installed in the overboard line to measure the total discharge flow. The analyser can be fully monitored remotely, and uses deep UV fluorescence to directly measure the aromatic proportion of hydrocarbons which fluoresce. It has been validated against potentially fluorescent production chemicals from both Prelude and Crux operations. An inbuilt spectrometer provides further functionality within the analyser which may be helpful in informing some adaptive management actions.

The system is designed for the full range of flows and conditions expected during field life, with a discharge design max of 172 m^3/hr (140 m^3/hr inlet flow with up to 32 m^3/hr recycle flow). Minimum discharge flow rate is approximately 35 m^3/hr for short durations, however operational complexities mean that the typical operating minimum is approximately 70 m^3/hr inlet flow (with up to 32 m^3/hr recycle flow).

6.9.7 Pressure Relief System

The purpose of the pressure relief and liquid disposal systems (Unit 63000) is to collect and safely dispose of hydrocarbon-containing vapour and liquid streams that are released during start-up, shutdown, venting, draining, upsets, maintenance and emergency situations. The pressure relief system comprises high pressure (HP) and low pressure (LP) flare systems, and vents, specifically:

- **Dry Flare System** – comprising of a HP system which protects primarily process equipment and a LP system which provides relief for storage tanks.
- **Wet Flare System** – comprising of a HP system which protects primarily process equipment and a LP system which provides relief for storage tanks.
- **Acid Gas Vent** - where CO_2 extracted from the gas is vented to atmosphere.
- **Marine Vent** – located on the flare stack, approximately 30m below the main flare tips, it is the final pressure protection (tank relief valves) for the condensate and cryogenic tanks, as well as other smaller tanks. The marine vent is continuously purged with nitrogen and it is unlikely that significant GHG emissions will be emitted from the marine vent, which is equipped with a flow meter.
- **Maintenance Vent** - the vent is located in a different area to the main flare, and is primarily used as flare relief when the flare undergoes maintenance (approximately every 8 years). The maintenance vent is also the alternative destination for the tank relief valves which normally go to the marine vent. This is achieved by swinging a piping elbow to line up the marine vent piping to the maintenance vent header. The vent has a flow meter, and has been assessed for modification to an ignited system to reduce GHG emissions when in use. This is further described in Table 9-101. The maintenance vent is also used when preparing the tanks for maintenance when air is introduced into the tanks, and at the completion of maintenance to displace the air with nitrogen before introducing hydrocarbons back into the tanks. The vent during these activities largely consist of nitrogen and air, with minimal hydrocarbons.

The flare system is designed to meet and comply with relevant Shell standards, including reducing flaring emissions to ALARP. Shell reached the target of eliminating routine gas flaring from our Upstream-operated assets in 2025, moving faster than the World Bank's Zero Routine Flaring by 2030 initiative, to which Shell is a signatory. The target is consistent with the World Bank Zero Routine Flaring by 2030 initiative, which targets routine flaring of gas during oil production (upstream operations) and therefore does not apply to gas projects (i.e. including Prelude). While this target does not apply, Shell intends to minimise flaring to ALARP and acceptable levels (refer Section 9.12 for further details).

The HP flare system is designed to enable depressurisation of the facilities in a sufficient time that reduces the risk of equipment failure and loss of facility integrity in case of emergency ("blowdown" scenario), and for safely pressurising and depressurising the facility during start-ups and shutdowns and maintaining required export flowrates. The LP flare system is designed to dispose of low-pressure gases from various streams, namely boil off gas from butane, condensate, propane and refrigerant tanks as well as the produced water system. There is also flaring associated with facility shutdowns, trips, restarts and upset scenarios, which is discussed further in Section 9.12. The flare system will be operational throughout the remainder of field life through all activity phases, except when offline for maintenance.

The flare tips are designed for efficient combustion over the anticipated ranges in process conditions, which include:

- HP Warm Wet Flare tip flow rates ~74.5 to 274.6 kg/s; temperatures ~-26 to 72◦C.
- HP Cold Dry Flare tip flow rates of ~67.3 to 351.8 kg/s; temperatures ~-82 to 111.5◦C.
- LP Cold Dry Flare tip flow rates of ~17.6 to 25.2 kg/s; temperatures ~-102 to 49.9◦C.
- LP Warm Wet Flare tip flow rates of ~0.26 to 19.7 kg/s; temperatures ~28.7 to 100◦C.

The flare tips are fitted with a series of pilots (three on each LP flare, four on each HP) which are kept constantly lit via a stream of continuous fuel gas for purging operations, to maintain the pilot flame and prevent air ingress. Flow meters are installed on both the HP and LP lines to the flare tips to measure the total gas flow to each flare tip.

Each pilot has two thermocouples, one online and one in spare. The thermocouples are intended to be the primary means of monitoring the pilots. The secondary monitoring system is through both optical and thermal infrared cameras which provide visual flame indication, routed through the CCTV system to be broadly visible. The thermal camera provides real time analysis of the video feed to detect potential flameouts to alert the operator via DCS alarm.

Each pilot is designed with two ignition mechanisms. The primary means of flare pilot ignition is via the cylinder head temperature (CHT) gauge pilot ignition skids which rely on the thermocouple feedback to auto-ignite the pilots upon detection of loss of flame. When the pilot is above 150°C, the pilot flame is shown as "PILOT ON" on the local panel and control room operator console. When the pilot is below 150°C, the low temperature alarm ("PILOT OFF" < 150°C) is displayed and the automatic ignition sequence commences. During the automatic ignition sequence, if the system is not already in alarm, each pilot fires in turn at seven second intervals and stops after sixty seconds. If a pilot remains in alarm after one minute, 'Re-ignition Failure' alarms to alert the operator to repeat the ignition sequence via manually intervening on the control room operator console to re-initiate the ignition sequence.

Secondary ignition is via the Flame Front Generator (FFG) which is conducted in field utilising back up propane bottles to create a flammable gas/air mixture within the flame front line. When this mixture completely fills the line between the flare ignition package and the HP or LP flare tip, a spark is produced in the ignition chamber automatically and the flammable mixture is ignited. The resulting flame front travels through the mixture towards the flare tip where it will discharge via the pilot nozzles and ignite the pilot flames. Only one pilot can be lit at a time by the FFG. The in service propane inventory has been increased to provide backup supply for a minimum of approximately 96 hrs in conjunction with onboard storage inventory.

6.9.8 Steam, Power Generation & Condensate Recovery

Prelude's Steam, Power Generation and Distribution system (Unit 40000) is based on a steam cogeneration design to supply services to the FLNG facility at the required quality, availability and reliability to various process units during all operation modes. Since the plant is an offshore unit, the power generation system is based on a stand-alone operation. Steam condensate from process and utility consumers is collected in the condensate recovery and distribution system (Unit 41000) and treated in three segregated streams: normally clean condensate, potentially contaminated condensate (heavy hydrocarbons) and potentially contaminated condensate (light hydrocarbons).

Prelude total design power requirement is 74.9 (64.9+10) MW including the thrusters. Total design steam requirement is around 1300 tons/hr. Based on this total, 7 (6+1) steam generator boilers are installed on the topsides, each with a Maximum Continuous Rating (MCR) of 220 tons/hr capacity. The main electrical power generation is produced by 3 (2+1) steam turbine generators (STG) of 40 MW Extraction/Condensing Steam Turbines. Steam turbine generators are supplied with HP Steam directly from Marine Steam Boilers to produce electricity for all the process and non-process electrical consumers. If an STG trips, the remaining turbines are designed to ramp up quickly to take on the electrical load without major upset or interruption.

In addition to the main power generation, three Essential Marine Diesel Generators (EDG), (3 x 7.68 MW), are on stand-by during normal operations. The function of these EDGs include providing black-start capability, providing power to all essential consumers during a prolonged process shutdown or unavailability of the primary system, and providing power to bring the process to a safe and stable condition during power plant shutdown. Power load for critical instrumentation systems (such as the DCS, IPS, FUG, HVAC, Telecomms, Navigational Aids or other vital systems) are provided further short-term redundancy by the UPS system.

Users of electrical power include the living quarters, electric motors for pumps, air cooler fans (etc), fuel gas heater, utilities such as air compressors and HVAC, electric crane, lighting and small power. Intermittent and temporary users through all activity phases may also include temporary engines, pumps, compressors, lighting, small power, and batteries, as required.

Emergency power is provided by two Safety Of Life At Sea (SOLAS) designated emergency generator sets (A-40210) having capacity 1250 kW, located aft, supplemented by (A-40220) emergency generator having capacity 750 kW, located forward for secondary refuge power.

Autonomy of the emergency power generator is 24hr in accordance with SOLAS requirements in order to supply electricity to SOLAS critical equipment (e.g. control and safety systems, navigational aids, communications used in emergency, emergency lighting; and fire-fighting foam pumps).

In addition, uninterruptible power supply (UPS) supplies for a limited amount of time systems such as the DCS, HVAC system, telecommunications, navigational aids or other vital systems.

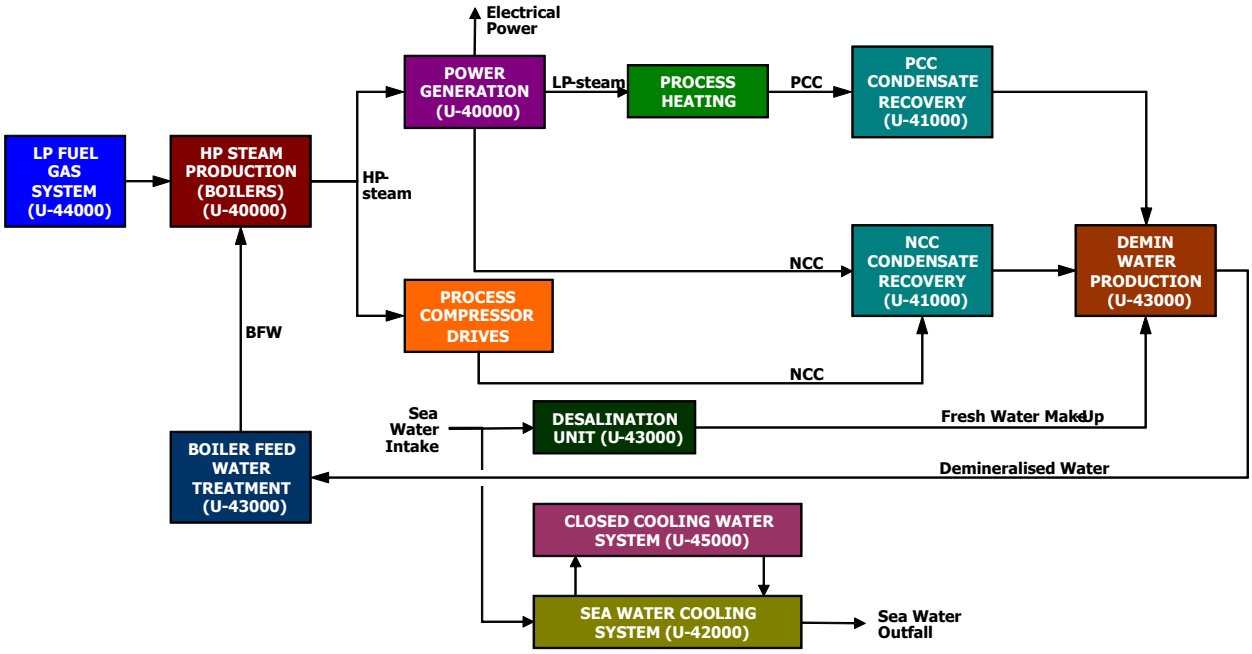


Figure 6-9: Prelude Utility Concept and Block Scheme

6.9.8.1 Fuel Gas System

Fuel Gas System Unit 44000 is designed to collect different sources of process gases, to heat and mix them in order to supply fuel gas to identified consumers at defined pressure, temperature, flow rate and quality (wet or dry). In order to improve the reliability and availability of the fuel gas to consumers, several variable sources of process gas are provided to the unit along with fixed sources. Dry fuel gas is used as purge to dry flare and blanketing of LNG/LPG tanks, whereas the mixed fuel gas is used for the boilers, purge to wet flare and blanketing of condensate tanks.

6.9.8.2 Diesel System

Diesel fuel is required throughout the facility lifecycle and all activity phases for backup power generation in case of non-availability of fuel gas or certain maintenance activities. The design of the diesel oil system includes receipt through diesel bunker, store, treat and distribute low sulphur diesel oil to various consumers in the Hull and Topsides and to occasionally refuel the supply boats.

Diesel fuel is supplied by bunkering from a supply vessel and transferred through hose reel (or alternatively through a secondary diesel oil loading station located at the aft deck boarding) via the diesel filter and a bidirectional metering unit to the storage tanks. Four diesel storage tanks, each with 750 m^3 storage volume have been provided for diesel storage in the FLNG's substructure. The EDG, aft fire water pump and aft EDG have their own day storage tanks. Similarly, the forward EDG and forward fire water pump have their day storage tanks for storing the diesel oil.

Some tasks through the activity period may require temporary diesel storage tanks to be mobilised on the facility. During all activity phases, the diesel fuel may be sourced from any of the tank storage locations on the facility to enable operational flexibility and redundancy in the event a pump or component is offline.

6.9.9 Seawater Cooling & Essential Seawater Cooling System

The Seawater Cooling Systems 1, 2, 3 and 4 (Unit 42000) and Essential Seawater Cooling System 1 (Unit 42500) provide seawater for cooling of the following systems:

- Essential Diesel Generators by Essential Seawater Cooling System 1 (SW1), which removes heat from the intermediate CCW1.
- Process coolers by SW2 via CCW2

- Utility equipment by SW3 via CCW3
- Steam Turbine Generators condensers, by SW4 (direct contact, no CCW4)

All seawater loops are injected with hypochlorite solution for biofouling control at their intake points, and the streams are returned to the ocean after removing heat (once-through cooling).

SW1 draws seawater from SW3 intake pumps and is used to provide a cooling source for CCW1 (HEX E-45501/02/03) to the essential diesel generator packages A-40510/20/30 and is needed to ensure their reliable operation in all circumstances.

SW2 supplies seawater to cool CCW2. Eight parallel seawater riser intake pumps P-42001A/B/C/D & P-42001E/F/G/H supply seawater to 16 seawater cooling exchangers E-45001 A-P. Together the 16 exchangers supply the total required cooling duty for CCW2. SW2 pumps water from approximately 150 m depth through seawater intake risers. The water at this depth is significantly cooler than at the surface and this improves the energy efficiency of the plant by reducing the power requirement of the PMR and MR refrigerant circuits and thereby reducing the overall fuel gas consumption.

SW3 supplies seawater to cool CCW3 through SW3/CCW3 heat exchangers E-45002A/B/C/D for users which could be essentials (users in operation even during maintenance phases) or non-essentials (e.g. lube oil coolers, air compressors, HVAC units, transformers). Additional redundancy and sparing are provided to SW3 to keep systems operational even when maintaining or repairing equipment. SW3 draws seawater from near the surface (~20 m).

SW4 supplies near surface (~20 m) seawater directly to the steam condensers of the three STGs E-40001/2/3. via four parallel pumps P-42004A/B/C/D.

6.9.10 Water Distillation

The purpose of Seawater Distillation, Service Water, Potable Water, Demineralisation Water Storage and Boiler Feed Water Facilities (Unit U43000) is:

- To supply water in the form of:
  - Potable Water to its respective users
  - Service Water for utility stations and hose connection
  - Make-up water for steam and condensate systems losses and for mixed beds
  - Regeneration.
- To treat Potentially Contaminated Condensate with Heavy Hydrocarbons (PCH).
- To supply de-mineralized water (DMW) to its respective users.
- To supply Boiler Feed Water (BFW) to boilers and de-superheating water to its respective users.

6.9.10.1 Seawater Distillation

The seawater distillation system removes salts from seawater to produce desalinated water. The produced distillate is then distributed to the service and potable water facilities and as make-up water for replacement of condensate and steam losses.

As the seawater is chlorinated to limit marine growth in the system it must be de-chlorinated prior to entering the distillation units to prevent contamination. The seawater is vaporised and the resulting distillate is cooled and routed to downstream users. The brine produced from the distillation process is routed overboard.

To clean the unit and remove the scale which has not been eliminated by the continuous feed water chemical treatment, an acid cleaning of the unit is performed using a weak acid (sulfamic acid or equivalent). The weak acidic solution remaining after cleaning is sent to the neutralisation tank to be neutralised before being discharged to the sea.

Desalinated water from the distillation unit is re-mineralised in a hardener bed to produce potable water, increasing hardness and alkalinity before it is disinfected via a silver ion steriliser. This water is stored in four freshwater tanks for use as service or potable water.

6.9.10.2 Demineralised and Boiler Feed Water Facilities

The demineralised and BFW facilities are provided to generate water with the required specification to allow for HP steam generation. Impure water will cause corrosion and scaling in the steam system and cause unnecessary downstream intervention and maintenance.

Power generation is based on a steam cogeneration system. Electrical power generation is by STGs. Heat is supplied by marine boilers fed with BFW to produce HP steam. The steam is then routed to downstream process and non-process users. The resulting steam condensation are treated to produce demineralised water which is then used as BFW.

To produce de-mineralised water (DMW) of the desired specification, mixed bed exchange polishers (two in operation, one stand-by/regeneration) are provided. The DMW further passes through three spray type de-aerators to produce BFW. The BFW is then pumped to the boilers. BFW is also used as medium for de-superheating and turbine washing. After BFW has been used for boiler operations, boiler blowdown is discharged to sea with flashed steam.

There is a neutralisation tank associated with the mixed bed polisher (MBP) BFW regeneration process, which is a water treatment package prior to being fed into the boiler feed water tank. The MBP regeneration process uses acid (HCl) and base (NaOH) to remove anions and cations from the beads in MBP unit. This regeneration waste liquid is then sent to the neutralisation tank for treatment ('pH neutralisation') before being discharged to sea. The neutralisation tank recirculation line and discharge lines also have an online analyser and alarm systems set on them which measures pH.

6.9.11 Electro Chlorination Unit

The function of the ECU (Unit 46000) is to generate, store and inject sodium hypochlorite solution to protect the following seawater equipment against biofouling:

- Seawater for once-through cooling loops: SW2/SW3/SW4
- Seawater for Distillation Packages A-43010/43020/43030
- Seawater for firewater pumps P-60001A/B (electric), P-60002/3 (jockey) and P-60000A/B (diesel)

The ECU employs electrolysis to generate a sodium hypochlorite solution required to treat the seawater intake and control biological growth. The process consists of passing seawater through an electrolyser cell with multiple metal plates across which a DC current is applied to trigger a reaction that produces sodium hypochlorite (hypo) and hydrogen.

Continually dosing hypo solution into seawater systems at low concentrations, below defined discharge concentration limits, effectively prevents micro and macro biological growth, which would result in fouling/plugging and corrosion of the equipment. Microorganisms can become chlorine resistant, therefore it is possible to intermittently "shock dose" the systems with higher hypo concentrations up to 2 hours in a 24 hour period.

The hypo solution generated by the ECU cells is sent to storage/degassing tanks and with a minimum residence time of 5 minutes to remove the hydrogen produced during the electrolysis reaction. Each tank is sized to have a sufficient capacity for peak continuous demands, plus a shock injection.

The hypo solution from the ECU also contains byproduct salts (typically Ca, Mg carbonates and sulphates) that precipitate, a fraction of which deposits on the equipment plates, and the rest stay in suspension as debris sent to users. Therefore, the ECU cells require regular cleaning using hydrochloric acid (up to 5% concentration). During this operation if weak acid inadvertently enters the degassing/storage tanks (e.g. due to valve failure) a secondary reaction will release chlorine gas. Hence the vents from the storage tanks are directed to safe locations to dispose of potential fumes.

Hypochlorite solution is injected from the degassing tank(s) to the following consumers:

- SW2 intake risers (8x pumps)
- SW3 sea intake (4x chests)
- SW4 sea intake (2x chests)
- Seawater distillation unit intake (1x chest)
- Firewater sea chests (3x)

During maintenance or shutdown periods when the seawater systems are not operational, the ECU will continue to generate and send hypochlorite to the intake points. This may also occur in firewater sea chests which are normally stagnant (some firewater pumps only run once per week for testing). In those cases, excess hypochlorite may be discharged to the ocean if there is no flow at the intake points.

Free Chlorine concentrations in seawater discharges from SW2/SW3/SW4 loops are maintained within operating targets and monitored through calculated values based on the hypochlorite solution concentration from the ECU and the measured hypochlorite flows injected to each loop, divided by the total seawater flows (either measured directly, or calculated from the differential pressure across pumps). The calculated values have been validated based on several years of operational data, and each month are verified against manual laboratory tests (SW1 only runs for a few minutes every week and a laboratory check is performed weekly).

6.9.12 Mono-ethylene Glycol (MEG) System

The purpose of the MEG unit (Unit 52000) is to store rich MEG before reprocessing and to inject Lean MEG into subsea or topsides facilities for hydrate prevention. MEG injection is required under the following scenarios, with the first four cases making up the primary use of MEG during shutdown, start-up, ramp-up and normal operations:

- Before a planned shutdown
- When plant is down after any planned or unplanned shutdown (at each well)
- During any start-up
- To pre-treat flowlines in the event of an unplanned shutdown
- During gas sweeping operations (before start-up)
- For well annulus management, during normal operation
- Whenever flaring from the HP separators or AGRU Feed separator
- For subsea and turret valve leak-off testing
- Unplanned hydrate remediation on the subsea or topsides.

Post Crux start-up, additional scenarios for MEG injection at Prelude FLNG will include:

- During pressurisation of Prelude topsides with Crux pipeline gas before start-up
- During any start-up and ramp-up of the Crux pipeline
- Pre-filling of HP Separator V-10011 before any Crux start-up to clear low level trips
- In response to off-spec arrival of Crux fluids
- During pipeline packed operation
- During loss of heating

There are two rich MEG tanks in the substructure with a capacity of 6000 m³ each and one forward rich MEG tank with a capacity of 2000 m³. There are also two 4000 m³ lean MEG tanks.

MEG is overboarded via the produced water discharge at low concentrations. The environmental risks associated with MEG are discussed in detail in Section 9.9.

6.9.13 Drains

The intent of the drain system is to provide a safe and environmentally responsible method of collecting and disposing of various streams. It is segregated into different zones and separate systems to avoid cross contamination, thus allowing for more efficient, safer spill and drain management. The drain systems include:

- Closed and cryogenic drains to prevent hydrocarbon flash to atmosphere and route fluids to flare
- Open drain systems to collect cleaning water, rainwater, deluge water, oily water, chemicals and other liquids
- Bilge system covering the open drains on Main Deck.

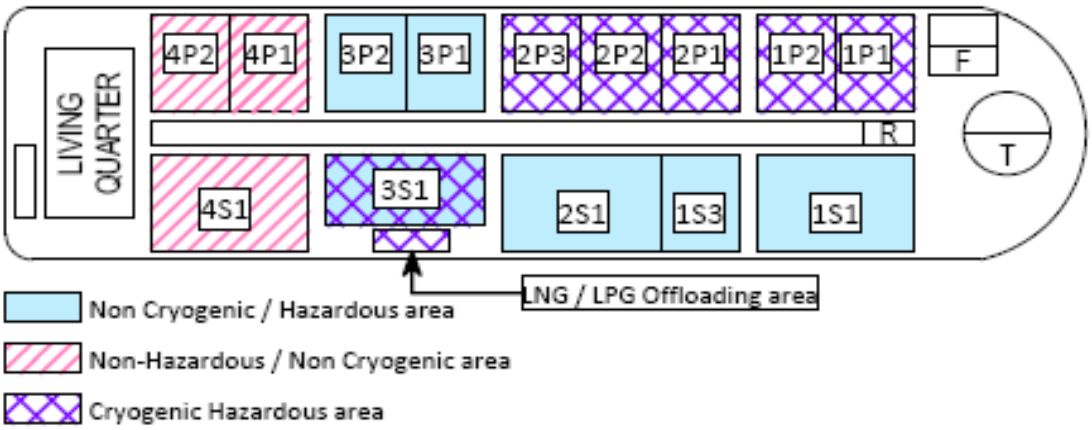


Figure 6-10: Drainage Zone Areas

6.9.13.1 Closed Drains

Two closed systems exist for hydrocarbon drainage, which divert liquids to the flare system (U63000). These closed drains are used for emptying vessel, column and line inventories after depressurisation and prior to maintenance. The closed systems are:

- Closed hydrocarbon Drain (CD)
- Cryogenic Drain (CRD).

Recovered hydrocarbon or non-vapourised fluids are stored in off-spec tanks for reprocessing in U-10000. The AGRU and MEG units have their own dedicated closed drain system for complete recovery of solvent and MEG.

All deck areas where there is a risk of cryogenic/LPG spill hazard are freely drained directly overboard. This is to avoid the risk of explosive clouds when cryogenics/LPG spills vaporise.

6.9.13.2 Open Drains

The open drain system is composed of several segregated sub-systems, each with a different function and hierarchy. The open drains systems (U65000) are used only after unit depressurization for maintenance works and are also used to collect relevant liquids. The intent of the open drain system is not to collect the liquid products during emptying of the connected hydrocarbon processing system. There is no hard piping connected from process equipment to the open drain system. The open drain material is either treated in the effluent water treatment unit, reprocessed in U10000 or stored in dirty slop/bilge tank. The open drain systems include:

- Open Hazardous Drain System (OHD)
- Open Non-Hazardous Drain System (OD)
- Open Chemical Drain System (OCD)
- Open Steam Condensate Drain System (OSD)

- Open Bilge Drain (OBD)

The Open Hazardous Drain system (OHD) and Open Non-Hazardous Drain System (OD) share the same function in respective areas. Drain headers are sloped towards the respective open drain vessels on Main Deck, which are also gravity fed fluids from drip trays and tundishes. Oily water is then separated and transferred to the slop/bilge tanks respectively, thereby disposing of deck run-off and liquids from potentially oil/hydrocarbon contaminated surfaces as a consequence of storm events, accidental spillage or washdown. Open non-hazardous area drains are completely segregated from any other open or closed drain system to avoid hydrocarbon vapour transmission from one drain to a non-hazardous one.

The Open Chemical Drain (OCD) system collects chemical spills from open drip trays and tundishes from topsides process modules, main deck and turret area. Drip pans in the Chemical Injection (Unit 50000), AGRU (Unit 11000) and MEG Injection (Unit 52000) Units are connected to both the open bilge drain header and open chemical drain header. The chemical spills drain header from hazardous and non-hazardous areas are segregated. The chemical spills drain header from the hazardous areas is sloped towards the Chemical Spills Collection tank, while main deck fluids due to elevation are pumped into the tank. Collected chemicals are pumped via Chemical Spills Collection pump to portable containers (tote tanks) for onshore treatment.

The open steam condensate drain system (OSD) is provided for each module (without any interconnection) to collect the Steam Condensate from the steam traps of the Steam Turbine, from the drip holes (located on Relief Valve discharge lines), from the silencers lines and from the level instruments.

The Open Bilge Drains System (OBD) covers the open drains facilities on the Main Deck (e.g. Aft/Forward Coamings, exposed deck scupper system, etc.), void space, insulation space (IS), cofferdam (C/D), bunker stations and machinery space. The liquid collected is gravity drained to sumps and then pumped to the dirty slop tanks (for hazardous areas) or dirty bilge tanks (for nonhazardous areas). The cofferdam bilges, MPPE bilges and refrigerant storage space is routed to the dirty slop tanks. Clean bilge and slops tanks are also installed, receiving fluids mainly from steam condensate and seawater/demineralised water streams.

The content of the clean and dirty bilge holding tanks are treated by oily water separators equipped with Oil Discharge Monitoring Equipment (ODME) analysers to monitor oil/condensate content in water before being discharged overboard from Clean Slop tanks. Separated oil is transferred to the sludge tank, which can be transferred to dirty slops tanks or offloaded via supply vessel. In case of off-spec water stream, the recirculation valve is open to return the off-spec stream back to Dirty Slop tanks, or to MPPE package for treatment.

During periodic testing or actual emergency use, suppression water, the deck integrated firefighting system (seawater) or the foam firefighting system will be normally discharged overboard. Bunding is provided for the chemical and oil storage areas with bund drain boxes and valve connections that can be closed during maintenance or refilling to avoid accidental discharge to the environment.

6.9.14 Chemical Injection System

Chemicals for Prelude are used at process and utility units. They are transported by supply boat and transferred from Intermediate Bulk Container (IBCs) to permanent storage tanks via gravity. The chemical storage and injection facilities (Unit 50000) are designed to supply chemicals to the users at the required quality, availability and reliability during all operating modes. The chemicals are stored in the permanent storage tanks which are divided in two compartments to ensure the availability of the chemicals during maintenance. Nitrogen blanketing is applied wherever an oxygen free atmosphere is required and provided on every tank as a basis of design.

Chemicals are mainly used for subsea, inlet facilities, produced water treatment, MEG reinjection, seawater distillation, boilers, water treatment processes and cooling water loop conditioning. The following key chemicals are in regular use throughout operations; working volumes and supply chain transition volumes will differ):

- MEG for well hydrate inhibition and for valve pressure equalisation during start-up (storage vessel ~4000 m^3 refilled via supply vessel bunkering, ~117 m^3 per delivery)
- Biocide to prevent micro-organism growth in diesel or waste oil system

- Hypochlorite injection to prevent micro-organism growth in service water, greywater, and sewage system which may be in the form of sodium hypochlorite or calcium hypochlorite as produced on Prelude.

MEG is supplied by bunkering from a supply vessel into the permanent storage vessel using a dedicated bunkering hose reel. All other chemicals are supplied in transportable tanks. Hose couplings on transportable chemical re-supply tanks are dry-break type to avoid loss of containment and have colour-coding and dedicated feed lines to avoid cross-contamination.

The facility may also require use of scale inhibitor, paraffin inhibitors and pour point depressant for sub-sea chemical injection, demulsifier, anti-foam, 33% HCL, 50% NaOH, scale inhibitor, O2/Cl2 scavenger, volatile amine, trisodium phosphate for topsides injection produced water treatment, desalination water production and boiler feed water treatment. These products are required to ensure smooth and stable operation and to prevent unwanted situations such as corrosion, blockage and foaming which could lead to process upsets or LoC. Assessment of chemical use is discussed further in Section 9.10.3.2.1.

A general chemical risk identified is uncontrolled reaction between chemicals in storage and drainage system. To mitigate this risk, the following designs have been implemented:

- The chemical drains were designed as per service (hazardous/toxic chemicals): i.e. drain lines are stainless steel, hydraulic seals are provided at the end of each sub-header, double block-and-bleed valves are installed on the tank, and an adsorption filter is fitted in the vent.
- Chemicals are stored in accordance with the Hazardous Materials Audit Matrix and as specified in the Dangerous Goods Register.
- All drip pans connections to the Open Chemical Drain tank (T-65050) are normally closed.
- In case of a small leak, the procedure is to contain the spilled liquid in the drip pan and flush it with water into the Open Chemical Drain Tank (T-65050); for significant leaks, the chemical is pumped manually into IBCs or any compatible container and sent onshore. The residence time of liquids in the Open Chemical Drain tank is minimised by emptying its contents into IBC containers and sent onshore.

During maintenance works on the chemical injection facilities, drainage of any chemical spills or of the cleaning/rinsing water is done after dilution. Drip pans are segregated to avoid any reaction between incompatible chemicals to avoid generation of heat, toxic vapour release or precipitation which could plug the drainage system.

Other non-injected process, miscellaneous chemicals such as hydraulic fluid, lube oil/seal oil, coolants, instrument air dryer beds, radioactive sources/nucleonics, TEG activated charcoal filters, biocide treatment, well annulus fluid and generic cleaning fluids (as examples) will be used for specific tasks, maintenance, and operational requirements. Chemicals are selected in accordance with the Shell Chemical Management Process (see Section 10.4.6).

6.9.15 Utility Systems

Nitrogen is required during all activity phases for the purging of equipment containing flammable substances, process purging, dry gas seals and tank blanketing. Nitrogen is supplied by Air Separation Units (U48000).

An electrical distribution system (including transformers and cables) is installed to distribute power to the electrical users via high voltage and low voltage distribution switchgear, including an electrical equipment room, field auxiliary room and transformer area. Additional utilities include an instrument and service air system that supplies dry compressed air for various users including the nitrogen generation system, tools, instruments, air driven pumps and instrument air purges (motors, panels, junction boxes, etc, as required).

Heating, ventilation and air conditioning (HVAC) systems with refrigerants are installed (including temperature, humidity, air motion, air quality, noise, and cleanliness) to provide a safe (non-hazardous) working area for personnel and equipment.

6.9.16 Control, Monitoring and Telecomms Systems

Prelude's telecomm and information systems provide all necessary telecomms and electronic warning systems necessary to support the safe and efficient operation of the facility and communications with onshore. These are based on a subsea fibre optic network as primary means of communication, with VSAT as a back-up. The system is standardised to ensure network compatibility and to maximise efficient maintenance. All well functions can be controlled remotely from Prelude FLNG. In addition to critical control and protection systems (DCS, IPS, FGS), the telecom systems encompass a range of auxiliary systems for monitoring, controlling, safeguarding, maintaining and managing the facility through all activity phases including but not limited to:

- Marine VHF Radio, for routine communications with other vessels.
- Aeronautical VHF radio, for helicopter landing/take-off operations.
- Trunked UHF Radio, for general FLNG facility communications.
- Public Address/General Alarm (PAGA) physically segregated redundant systems, to provide voice and alarm audible signals throughout the facility.
- Telephony, for general communication on the facility plus links to shore.
- SOLAS systems, for lifeboat and search and rescue communications.
- Electronic berthing aid systems, for guidance to very large carriers pilots from 10 miles distance to the loading point.
- CCTV systems, for safety and operational process monitoring and to complement existing radars for identification and imaging of detected objects around the FLNG.
- Communication Control Interface Radio System, for interface with all radio and voice communication systems by control room operators.
- Telecom Supervisory system, to track Telecom and Navigation systems health status.
- Process Control Domain systems, to control and operate process infrastructure.
- Alarm Integration, to facilitate monitoring and critical alarm communication across the facility.
- E-Mustering and Access Control, to track and manage movement of personnel across the facility.
- Weather Monitoring System (WMS) to provide real-time meteorological data collection and display.
- Differential Global Positioning System (DGPS) units to provide position information for berthing systems, AIS, and ARPA.
- Radar with long range (S band) and accuracy (X band) features fitted with ARPA and AIS systems to provide trajectory predictions and collision avoidance alerts for safety marine operation in the vicinity of Prelude.
- An electronic berthing aid system to provide guidance to cargo carriers pilots from 10 nm to the loading point and keep records of all approaches and moorings made for the purpose of optimising speed and time.
- FLNG to Carrier Link System to provide an interface between safety instrumented systems, primarily for emergency shutdown (emergency shutdown over dedicated UHF link is also provided for condensate tankers).
- Supervisory system to record health and alarm status.
- Human Machine Interface (HMI) to manage control of the Crux platform with sufficient information for operation in case of degraded communications incorporating outputs from Crux control and protection systems
- Crux sequence of events recorder to capture the status change of all inputs and outputs for systems management

- Remote monitoring, control and operation of Crux systems - this enables the management of any potential flow on effects to Prelude.

6.9.17 Protection Systems

Prelude FLNG has several mechanisms which help protect against loss of containment events, which include:

- Passive and active fire and explosion protection which includes blast walls and safety infills to mitigate the consequences of explosions on equipment and areas of the facility, and firefighting systems (water, foam, chemical) to minimise spread of fire upon detection. Blast resistance is also applied to structure and critical elements that may potentially be exposed to blast loads but are required to perform their function after an explosion event.
- Safety shutdown systems, valves; blowdown sequence designed to isolate and depressurize process modules in event of an emergency scenario, i.e. confirmed fire or gas detection.
- Optimised design minimizing common leak sources.
- Navigational aids to enable the facility to be visible to marine and aviation traffic, and to signal a safe line of approach or departure for helicopters, radar beacon and main navigation lights to alert marine vessels and aircraft of the position and prevent collision with the facility.
- Collision avoidance Automatic Identification System (AIS) is provided for collision avoidance to detect marine traffic and provide warning.
- Metocean data gathering system provides a Real Time Metocean Monitoring System to alert personnel to adverse weather by providing accurate, continuous, real-time metocean data for decision making when conducting weather sensitive activities to help prevent weather related incidents.

In addition to these protection mechanisms, the structural design intent of topsides and substructure (materials, corrosion protection, etc) is to maintain structural integrity under all expected actions through service life and provide sufficient robustness to maintain availability of critical systems during a major incident. Handling equipment on the topsides (e.g. underhung gantry crane, monorails, davit, and pedestal crane) is designed to ensure that loads can be lifted and mechanically handled, without dropped object or swinging load risk. Process containment equipment (such as process vessels, heat exchangers, rotating equipment, piping and relief systems) are designed to maintain integrity of the containment envelope through protection for mechanical failure (e.g. gas detectors, flame monitoring and dedicated suppression/water mist), materials corrosion and erosion allowances, vibration control and protective coatings.

Design accounts for transient pressure and temperature, environmental, mechanical, and dynamic loads with relief devices to prevent overpressure in pressurised hydrocarbon gas/condensate containment systems in the event of loss of process control, fire or any other credible overpressure scenarios. Ignition control systems are also designed to prevent the ingress or build-up of flammable hydrocarbon gas-air mixtures or dangerous atmospheres by ventilation systems, certified electrical equipment, earth bonding devices, and area classifications. Helicopter facilities include a passive fire retarding helideck, helideck perimeter lights, self-contained deck integrated firefighting system, safety perimeter net and helicopter crash/rescue equipment.

6.9.18 Other Facilities

6.9.18.1 Ablutions

The sewage system on Prelude collects black water, greywater and sweat drains from the living quarters (and aft machinery space toilets); The vacuum toilet system reduces particle size of the waste stream, and sewage is further comminuted through pumps and screens before discharge. Food waste is also similarly macerated for discharge. These streams are discharged ~11.5 m below the sea surface. The forward temporary refuge is self-contained, disconnected from the facility's sewage system and is not in use outside of an emergency scenario. Temporary toilet units may be set up to support large campaigns or shutdowns; sewage or greywater from these will be discharged through temporary piping/hoses.

6.9.18.2 Laboratory

The onboard laboratory is located within the accommodation block, behind the blast wall. It will incorporate any offshore testing requirements from Crux delivered by helicopter or vessel. The laboratory conducts operational analyses and provides manual sampling arrangements when equipment is unavailable. A variety of chemicals are in use, approved via Shell's Chemical Management Process, and either not discharged or typically discharged in small volumes and/or low concentrations. Laboratory (greywater from basins) contaminated water is processed via the Prelude slops tanks.

6.9.18.3 Lighting

The Prelude FLNG facility and supporting activities require 24-hour external illumination to meet maritime and safety standards (navigation, operations and flaring). The impact of artificial light emissions are risk assessed in Section 9.4.

6.9.18.4 Fire and Suppression Systems

Active Fire Suppression systems are installed on Prelude and regularly tested to minimise escalation potential from pool fires, utilising mist and deluge spray systems supplied with seawater or firefighting foam. A water based Deck Integrated Fire Fighting System is provided for each helideck. Passive fire protection in the form of tested and approved paint coatings is strategically applied and periodically inspected throughout the facility to provide certified duration of jet fire protection.

6.9.18.5 Metocean Monitoring

A real-time weather monitoring system is installed on the facility to support helicopter and vessel operations. There is also metocean monitoring equipment deployed (such as waverider and oceanographic met buoys) in the Activity Area to provide a comprehensive understanding of meteorological, oceanographic, or biological conditions for monitoring and surveillance purposes, planning activities, and informing inspection, repair, or major maintenance activities. Dedicated metocean studies are outside the scope of this EP.

6.10 Operations Activities

Operations includes all activities associated with operating the facilities for the purposes of production and processing of Prelude and Crux fluids (at Prelude FLNG). This includes IMR, support vessels and helicopters within the designated safety zones, offtake and bunkering vessels when attached to Prelude and potential well intervention or emergency response events.

6.10.1 Side-by-Side Mooring and LNG/LPG Offloading/Import

LNG/LPG carriers are moored alongside the starboard side of the Prelude FLNG facility utilising mooring lines and separated via fenders. Mooring lines can be remotely released from both a local control unit and a remote control unit in the Prelude marine control room in case of emergency event. Marine loading arms are designed with emergency shutdown controls, and all bunkering hoses are fitted with marine breakaway couplings to protect from surge pressures and fluid release.

6.10.2 Tandem Mooring and Condensate Offloading

A tandem mooring and offloading system is fitted at the stern of Prelude for offloading condensate cargo to a condensate tanker. The condensate tanker is moored to the Prelude FLNG facility by a tandem mooring hawser configuration. When not in use, the hawser and condensate hose is recovered onto a storage reel.

6.10.3 Maintenance and Facility Shutdowns (Turnarounds)

Regular maintenance activities are carried out daily on the Facility. Maintenance activities are extensive, and include risk-based inspection (RBI), preventative maintenance, condition monitoring, and generic maintenance. Activities can include, but is not limited to:

- Breaking containment of vessels, opening lines, topping up and changing over fluids, chemical cleaning, pressure testing, draining water systems, testing valve function, changing filters, localised surface abrasive blasting and painting, general cleaning, and pressure cleaning

- Removal, replacement, repurposing, and installation of equipment to facilitate safe and reliable operations in line with design intent

In addition to routine scopes, brownfield mechanical works and modification scopes are planned and executed on the facility to replace, upgrade or improve equipment and system functions. These works range in scope and are addressed as required through a Scope of Validation submitted to NOPSEMA under Regulation 2.24 of the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009.

Planned maintenance shutdowns ("turnarounds" or smaller "pitstops") are scheduled at regular intervals to complete inspections, maintenance, modifications, and repairs that cannot be performed during production. During these shutdowns, the topsides facility is largely depressurised and offline.

Maintenance shutdowns are supported by helicopter and marine logistics, including supply vessels and bunkering. Temporary facilities for additional personnel, waste handling, and material storage may be required during major turnarounds. Environmental impact from such temporary facilities are not expected to exceed that of Prelude, the key emissions, discharges, and impacts of which are outlined in Section 9.

6.10.4 Inspection, Maintenance and Repair (IMR)

Section 572(2) of the OPGGS Act requires a titleholder to maintain in good condition and repair all structures, equipment, and other property (hereafter collectively referred to as 'property') that is within the title area and is used in connection with the operations authorised by the title.

Inspection of the facilities (subsea, wells, substructure, topsides) is conducted in accordance with an RBI schedule and will occur throughout all activity phases to preserve the safety, reliability, and integrity of the facility. Surveillance, inspection and monitoring programs may also use any combination of manned, robotic, autonomous (e.g. underwater vehicles, underwater drones, aerial drones) or semi-autonomous vehicles (e.g. ROVs connected via umbilical) and deployed from support vessels, Prelude FLNG or mainland.

Maintenance and repair activities on Prelude are extensive, and include condition monitoring, predictive maintenance, and corrective maintenance. Maintenance on the facility is wide-ranging and can include, but is not limited to:

- breaking containment of vessels, opening lines, topping up and changing over fluids, chemical cleaning, pressure testing, draining water systems, testing valve function, changing filters, localised surface abrasive blasting and painting, general cleaning, and pressure cleaning
- repair, removal and/or replacement, of equipment to facilitate safe and reliable operations in line with design intent

A risk assessment and supporting demonstration that impacts and risks are managed to ALARP will be conducted for any liquid discharges or air emissions associated with maintenance activities that are any different to what is covered by the described activities.

6.10.4.1 Subsea Inspections and Surveys

Subsea inspections provide assurance that infrastructure is being maintained and operated according to design and proactively identifies maintenance or repair activities that may be required. Inspection generally involves the use of a vessel travelling along the route of the subsea system with an autonomous underwater vehicle (AUV) or remotely operated vehicle (ROV).

Inspections are typically less frequent during steady-state operations, depending on previous inspection results. At a minimum, subsea inspections are conducted on an approximately 3 yearly basis. This involves the mobilisation of an ROV campaign for several weeks. Inspections may occur more frequently subject to equipment performance and outcomes of previous inspections on a risk based inspection principle. Inspection techniques may include:

- visual inspections may involve ROVs or AUVs deployed from a Prelude or another vessel
- marine acoustic surveys may include the use of side-scan sonar (SSS) and multibeam echo sounders (MBES) and are typically done from a vessel using towed acoustic instruments, ROVs, or AUVs

- non-destructive testing (e.g. for pipeline wall thickness) may include pigging, ultrasonic testing, or electrical resistance testing, which are typically undertaken using an ROV or AUV deployed from a vessel or Prelude
- cathodic protection measurements may be completed using ROVs or AUVs and conductivity probes or by making visual assessments of anode wastage
- fatigue monitoring/inspection may use fatigue monitoring equipment to be installed, inspected, and/or retrieved by a ROV deployed from a vessel or Prelude
- seabed, benthic and marine growth sampling
- sub bottom profiling using low frequency echo sounder
- dimensional/laser surveys.

Pigging or intelligent pigging may be used to inspect the export pipeline condition. Conditioning (cleaning or batch) pigging is typically required before a pigging inspection run and requires a pig to sweep any debris and gauge the pipeline to ensure that the pipeline is in suitable condition for a subsequent pigging inspection. Batch pigging may also be required to distribute chemicals (e.g. corrosion inhibitor) or remove hydrates or other contaminants. Pigs are launched from the platform through the export pipeline to the receiver on Prelude FLNG.

Monitoring of subsea infrastructure refers to the process of surveillance of the physical and chemical environment that a subsea system or component is exposed to determine if damage may occur, and (where relevant) predict the rate or extent of that damage. Monitoring activities may include process composition testing, corrosion mitigation checks, metocean and geological seismic monitoring, and cathodic protection testing.

6.10.4.2 Subsea Maintenance and Repair

Subsea maintenance activities, system maintenance, equipment replacements, refurbishments and change-out may be undertaken to prevent deterioration and/or failure of infrastructure; maintain reliability and performance of infrastructure, and ensure infrastructure is adequately maintained to enable the potential for future removal. Valve function testing and cycling of valves may be performed from Prelude with observations by the ROV or control system, or manually performed by ROV, and routine testing is likely to result in small quantities of fluids being discharged. Marine growth and calcareous deposit removal may also be undertaken by water jetting from an ROV, generally with potable water or seawater, although items exhibiting calcareous deposit accumulation may require acid washing or soaking (typically using water-soluble sulphamic acid or similar). This task may precede other maintenance activities, where operation of or access to the equipment is hindered by marine growth or calcareous deposits. Stabilisation may be required to manage spanning and scouring around the subsea system and may involve installing mattresses, grout bags, rocks, frond mats or similar stabilisers, or trenching (etc). Localised excavation may be conducted directly adjacent to the subsea system, allowing access to buried or partly buried infrastructure. Typically, this is conducted by jetting and/or digging equipment from an ROV or vessel. This task generally precedes valve function testing, pipeline repair and equipment change-out. Flushing of hydraulic lines may be required for replenishment or repair of hydraulic systems. Leak and pressure testing may be required to test integrity of infrastructure.

Given the nature of the operating environment, subsea preventative maintenance and repair activities are generally limited to short duration (hours) annual valve stroke/function testing, unless there is an equipment impairment requiring corrective intervention, or inspection outcomes require additional IMR work to mitigate identified risks. Maintenance and repair activities are typically conducted in response to inspection findings, engineering analyses, and/or external events. The activities are likely to be performed by ROV from the IMR vessel (or similar) used for inspections, or in exceptional circumstances may require the use of a larger vessel. IMR activities may involve the occasional subsea discharge of small quantities of fluids (typically MEG, biocide, hydraulic fluids, acid or well fluids) and/or minor seabed disturbances. These infrequent releases are risk assessed in Section 9.10 and 9.12.1.

Subsea IMR activities such as pressure leak testing, flushing, hot stab operations, umbilical or hydraulic flying lead replacement, SSIV flushing (etc) all have potential for minor releases of residual hydrocarbon liquids and

gas, chemicals, nitrogen, control fluids, and hydraulic fluids the volume of which depends on the geometry, pumping rates and task specific requirements.

If sediment builds up around subsea infrastructure, an ROV-mounted suction pump unit may be used to relocate the sediment to allow inspection/works to be undertaken. This activity is limited to the relocation of small amounts of sediment material in the immediate vicinity of the subsea infrastructure.

Equipment, materials, or tools may need to be temporarily wet stored on the seabed in the Activity Area during minor repairs. This could include, but not be limited to, work baskets for ROV tools prior/after connection, damaged components, etc. A wet parking frame is monitored and maintained in the Activity Area. The frame and any wet stored items will ultimately be removed as with other subsea infrastructure when the field is decommissioned.

Surveillance via installed monitoring equipment includes continuous monitoring of pressures, temperatures, flow rates and sand production rates at various locations in the subsea system, supported by lab testing of produced fluids and the chemicals injected to maintain the production system. This ensures that the status of the system is continually known, and that any early indications of potential degradation/failure are acted upon promptly to maintain the condition of equipment/ hardware and structures in an appropriate state until cessation of production.

Through these activities Shell will meet the obligations under the OPGGS Act (s.572(2)) to ‘maintain in good condition and repair all structures that are, and all equipment and other property that is: (a) in the title area; and (b) used in connection with the operations authorised by the permit, lease, licence or authority’.

6.10.5 Well Surveillance, Inspections and Maintenance

Management of the wells will be in accordance with the WOMP, which sets out requirements for ongoing wellhead monitoring and leak detection. Through implementation of the WOMP, Shell is meeting its regulatory obligation under the OPGGS Act (s.572(2). As part of ongoing well and subsurface systems maintenance, during the activity period, there may be ongoing well and subsurface integrity testing and surveillance undertaken using vessels and/or ROVs. Related activities may include pressure testing, repairs or replacement of components, lubrication and rectification works to address integrity issues such as corrosion, leakage, erosion and general wear and tear. Given the nature of the operating environment, wells preventative maintenance and repair activities are generally limited to short duration (hours) annual well inflow testing, unless there is an equipment impairment requiring corrective intervention.

Surveillance and inspection activities may indicate the requirement for further maintenance on system components which will be scheduled for maintenance periods. This may include for example tubing downsize, replacement or repair or valve inserts (such as surface-controlled subsurface safety valves), trees, or tree components, well perforations, water shut-off (in the event of formation water breakthrough), and upper completions replacement. Depending on the nature and scale of these maintenance tasks, additional well intervention equipment may be mobilised with a MODU alongside vessels and ROVs, noting that a MODU would require additional approvals. For well intervention works, depending on the task and activity, well bore fluids, well plugs or inhibited brine may be required to make wells safe during the activity.

6.10.5.1 Well Intervention and Workover

While there are planned inspection and surveillance activities during the five-year life of this EP, there are no planned well intervention or workover activities unless identified by the inspection and surveillance program (workover however, may be required throughout the activity lifecycle).

Interventions may be undertaken for reservoir surveillance, enhancing productivity, assessing wellbore condition and restoring well integrity. Well interventions may also include tree/wellhead maintenance, logging or surveys, mitigating safety critical failures (e.g. failed safety valve), and production logging improvement activities.

When top-up of the well annulus with MEG is required, up to 15 bbl of MEG will be injected into the annulus in 5–10 bbl increments (pressure dependent). After allowing the MEG to “flip” with the base oil in the annulus, annulus pressure will be bled off with returned base oil being flushed to the surface via the flow/return umbilical. Injection of MEG and return of base oil will be repeated until the required volume of MEG has been pumped

into the annulus. Returned liquids will be stored onboard the Light Well Intervention Vessel in the waste liquid tank. As this is a closed loop system, there are no planned discharges to sea.

If required during the life of this EP, well operations would be executed and managed by the Wells Delivery team, interfacing and concurring with asset groups as appropriate. The work would be conducted in accordance with Prelude FLNG Permit to Work controls. Management of these activities are detailed in the Prelude WOMP.

ROV(s) are used from the vessel in support of the well intervention activities. The ROV(s) are a standard work class ROV, with any specialist equipment or tooling required mounted on the ROV. An observation class ROV may also be employed to assist the work class ROV where appropriate.

With respect to well integrity, management of the wells will be in accordance with the NOPSEMA accepted Prelude WOMP, which sets out requirements for ongoing wellhead monitoring and leak detection. Through implementation of the WOMP, Shell is meeting its regulatory obligation under the OPGGS Act (s.572(2)) to 'maintain in good condition and repair all structures that are, and all equipment and other property that is, in the title area and used in connection with the operations'.

For wells and seabed infrastructure, through the development and eventual implementation of the decommissioning plan, Shell will meet its obligations under s. 572 (3) of the OPGGS Act 'to remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations'.

6.10.5.2 Light Well Intervention

6.10.5.2.1 Light Well Intervention (LWI) Vessel Description

The following describes a typical vessel to be used for offshore well intervention activities.

Planned well intervention activities are executed by LWI vessels with an accepted vessel Safety Case for those activities consistent with the OPGGS(S) Regs 2024. Should the vessel scope demonstrate functionality or significant hazards that are not captured within the accepted vessel Safety Case scope, then a re-assessment shall be undertaken accordingly. This shall be followed by a consultation and revision to the existing vessel safety case, as required by the OPGGS(S) Regulations 2024.

Shell has a framework agreement in place for the provision of a fully integrated LWI service including vessel, subsea intervention device (SID), ROVs, slickline/wireline services, bleed-off package services and project management under Shell's Well Engineering oversight.

The LWI vessel contractor shall ensure that such a LWI vessel has the required vessel documentation accepted by the various legislative bodies for use offshore in Australian waters. More details on the specific LWI vessel used on Prelude can be found within the datasheet included in the vessel Safety Case.

6.10.5.2.2 Light Well Intervention Vessel Safety Critical Equipment

Safety critical equipment will be detailed in the LWI vessel Safety Case. Where applicable each LWI vessel Safety Case is reviewed by Shell in conjunction with the Prelude FLNG Safety Case to ensure that there are no omissions with regards to safety critical equipment. There are a number of key controls with interfaces to the Prelude FLNG Safety Case and this EP which shall be scrutinised at this review of the vessel safety case, and thereafter at the maritime vessel assurance reviews. Examples of physical controls that relate to environmental protection and this EP include:

- Navigation equipment and aids (including audible and visible warnings)
- Communication equipment
- Dynamic positioning system
- Lifting equipment
- Back-up power supply
- Emergency shut-down, alarm and lighting systems.

6.10.5.2.3 Remotely Operated Vehicle(s) (ROVs)

ROVs are used from the LWI vessel in support of the LWI activities. The ROVs are standard work class ROVs, with any specialist equipment or tooling required mounted on the ROVs. Observation ROVs may also be employed to assist the work class ROVs where appropriate.

6.10.5.2.4 Subsea Intervention Device (SID)

Well interventions require well bore access into 'live' wells. A SID is deployed and utilised to allow wellbore access while maintaining well control. Basic particulars of a SID are listed below. Any selected vessel contractor shall ensure that such a SID shall meet the functionality and operability as per the approved WOMP as required by the OPGGS (Resource Management and Administration) Regulations 2011. SID typical details are as follows:

- System Working Pressure: 10,000 psi
- Umbilical pressure rating: 7,500 psi (4x ¾" (19 mm) lines)
- Min Bores Size: 7-3/8" (187 mm)
- SID Ram/Valve configuration: Capacity for two (2) sealing barriers in place for all well interventions
- Subsea Connector Type: 18-3/4" (476mm) H4 10,000 psi
- Subsea Intervention Lubricator Length: 60ft.

6.10.5.3 Light Well Intervention (LWI) Operational Considerations

With two well barriers in place the tree cap can be recovered. After tree cap recovery the SID will be deployed onto the subsea production tree using a heave compensated crane on the LWI vessel. After deployment of the SID onto the subsea production tree the SID will be pressure tested to Closed-In Tubing Head Pressure (CITHP) plus a margin. SID umbilicals and slickline/wireline will be compensated.

Control of the production tree valves during well entry will be via the SID umbilical system or managed through a lock out interface with FLNG. The LWI vessel has the necessary tooling for ROV intervention also.

If required, subsea production tree valve cavities and the A-annulus may be flushed/ topped with inhibited MEG from the LWI vessel. This will most likely be completed using a down line from the LWI vessel or via ROV as an alternative.

With sufficient well barriers in place the SID will be placed on the next well or recovered to the LWI vessel. A tree cap will be installed and pressure tested with an ROV.

6.10.5.4 Potential Light Well Intervention Requirements

Light well interventions required on the Prelude wells, post suspension plug recovery, will in principle be the result of a well integrity issue needing an investigation or repair. These activities may need to be carried out at any point during the life of this EP. Potential well intervention triggers may include:

- Completion tubing leak
- Production packer leak
- Loss of A-annulus integrity
- Subsurface safety valve functionality issues
- Subsea production tree valve leak.

Well interventions most likely require a well entry using slickline/wireline. This can be executed by a vessel with Light Well Intervention capability similar to the LWI vessel used for the planned suspension plug recovery operation. As a result, Section 6.10.5.1 and all requirements and associated references are also applicable to contingency LWI activities.

Although the in-well activities and objectives are different, the risks and hazards are effectively identical to suspension plug recovery. Hence the Commissioning & LWI Well Integrity Risk Register will apply for these operations.

Below are some of the contingency LWI activities listed which may be applicable from suspension plug recovery through to the commissioning and production (including start-up) activities.

6.10.5.5 Slickline/Wireline interventions

The likely types of slickline/wireline intervention that may be required during the Prelude well life cycle are detailed further in this section.

Deep Set Plugs

Setting a deep-set plug would most likely be triggered by a well integrity concern, coming from a tubing or production packer leak into the A-annulus.

If the leak is in the tubing, then the most likely plug will be a slickline conveyed plug set in the nipple profile located in the completion tail pipe.

A leak of the production packer itself will require a high expansion plug set in the 7” (178 mm) liner. This plug will be run on e-line and potentially requires the use of a tractor and setting tool.

6.10.5.6 Sub-Surface Safety Valve Repairs

Sub-surface safety valve functionality issues may also lead to an intervention. The most involved operation that would be attempted would be to run an insert valve. This operation involves four main slick line runs (with possible drift and check runs in between). The operational steps are:

- Run in Hole (RIH) and exercise the sub surface safety valve. This involves shifting the sleeve up and down using a dedicated wireline tool.
- RIH with a lock open tool. This trip involves stroking the sleeve of the sub surface safety valve down and locking it in this position using a dedicated wireline tool.
- RIH with a punch/ communication tool. This dedicated wireline tool will create hydraulic communication with the sub surface safety valve control line.
- RIH with the insert safety valve. The valve is deployed on a lock that sets in the nipple profile above the subsurface safety valve. With the lock set in the profile the valve straddles the punched port allowing the control fluid to reach and function the insert safety valve.

6.10.5.7 Investigation Run

Prior to, for example, rectifying a leak and/or subsurface safety valve issue, it is likely that an investigation tool will be deployed on slickline/wireline to better understand the issue. Typical examples would be:

- RIH and run an acoustic tool to detect the location of a potential tubing leak.
- RIH and run a downhole camera to obtain an imagine of the sub-surface safety valve internal condition.
- RIH and run a calliper or drift run to investigate any changes in well bore internal geometry.

6.10.5.8 Well Surveillance Well Entry

Although not envisaged it is possible that a slickline/wireline run is required for well surveillance purposes e.g.:

- RIH with an expandable gauge carrier to obtain downhole pressure and temperature in case the permanent downhole gauge is not functioning.
- RIH with a drift run to investigate a potential blockage below the completion tail pipe.

6.10.5.9 Well Production Reinstatement

In the unlikely event that sand production becomes an issue, there is the opportunity to run a slickline/wireline deployed sand screen hung off in the nipple profile located in the completion tail pipe.

6.10.5.10 Christmas Tree Changeout

In the unlikely event that the valves on a Christmas tree could no longer perform their function as a barrier or the tree was damaged, the tree would be removed. A dry hole tree would be run in the interim to isolate the well until the tree was repaired and replaced.

6.10.5.11 Isolations from FLNG

With FLNG on location it is imperative that isolations are put in place during a LWI to isolate the wells and the well intervention activities from the production facility and other wells. A number of FLNG Operating Procedures are in place to ensure adequate and tested isolations are in place. These isolations are critical in preparation for handover of the well from the asset to the wells team and vice versa at the start and end of the intervention activities. The specific procedures deal with:

- Prelude Subsea Isolation Strategy
- Lock-Out Tag-Out (LOTO) Manual
- Well Handover Procedure

6.10.6 Removal of Equipment

Throughout all activity phases, when equipment is replaced, an assessment of the redundant equipment will be undertaken to evaluate the feasibility and risks associated with removal. Where removal is deemed to pose an unacceptable risk to existing operational infrastructure, redundant infrastructure items may be left in-situ. Items are recorded as part of the ROV as left survey (if subsea) and included in the asset register. The asset register is used to track equipment to enable planning for future removal. Any redundant equipment left in-situ will be maintained in the asset register. ROV surveys also facilitate maintenance activities in accordance with established risk based inspection requirements. These largely comprise of non-intrusive inspections such as general visual inspection, cathodic protection probe inspection and checks, marine growth checks, seabed and free span checking and measurements, azimuth and mooring surveys. Decommissioning is detailed further in Section 10.5.13.

6.10.7 Logistics

6.10.7.1 Aviation Support

As a continuously manned facility, Prelude requires logistics support from the mainland of Australia. The primary means of mobilising personnel to the facility is by helicopter via Broome as the primary helicopter base. Djarindjin (also known as Lombadina) is used as a refuelling point to optimise operational efficiency dependent on environmental conditions. These helicopter bases may change in the future as company requirements may change. However, as the onshore bases are excluded from the scope of this EP, any change to the location of the base does not change the environmental risks from helicopter operations within the Activity Area. Refuelling may also occur on the facility and helicopters may be used for shipment of materials to and from the facility, vessels and the Crux platform, and to undertake medevac operations, as required.

6.10.7.2 Infield Support Vessel

The Infield Support Vessels (ISVs) support the operations of the Prelude FLNG facility, primarily fulfilling the role of Standby Vessels. Typically, two ISVs are present in the Prelude field area based on a rotation basis.

The ISVs perform the following roles and functions:

- Each ISV is provided with a Fast Rescue Craft (FRC) to facilitate rescue of persons from sea and where necessary the guiding of free floating life rafts.
- In a major emergency, the ISV acts as an emergency evacuation vessel.

- Acting as a place of safety or having the ability to transfer to an alternative vessel offshore or helicopter.
- Firefighting with capability commensurate with notation Fi-Fi 1, with remote operated main water monitors and foam drenching system.
- Ability to provide Tier 1 oil spill response.
- 24/7 security surveillance for other vessels that might pose a threat to Prelude using existing systems (e.g. radar, floodlighting and other means of surveillance).
- Monitoring and maintaining traffic activities in the safety zone.
- Perform side by side berthing and unberthing operations for LNG and LPG Tankers.
- Perform tandem berthing and unberthing, hawser and hose handling operations of offtake Condensate tankers.
- Provide support during offloading of tankers.
- Enable transfer of FLNG Terminal Team staff and equipment to the tankers upon arrival and return to FLNG on departure.
- Terminal Team transfer from the FLNG is primarily from the Preludes bow catcher located on Preludes Stern with secondary access being at the Port and Starboard doors.
- Perform environmental monitoring (or another similar vessel) if possible.

6.10.7.3 Marine Support Vessels

Marine support vessels, including Platform Support Vessels (PSV), Multipurpose Platform Supply Vessels (MPSV), and Anchor will support Prelude activities through provision of the following scopes of work:

- Port operations (Loading/discharging of cargo and specialist equipment)
- The safe transportation of cargo/equipment to and from FLNG facility
- Offshore Installation operations (Discharging/back-loading of cargoes and specialist equipment)
- Anchor handling/towing operations (AHTS vessels only)
- Infield emergency response support e.g. oil spill response, helicopter operations standby support
- IMR and other surveillance activities.

Vessels will typically use dynamic positioning (DP), however in certain circumstances, use of pre-laid moorings may be required. Vessels are likely to be fuelled by marine diesel oil (MDO) or Marine Gas Oil (MGO) including low sulphur Marine Gas Oil (LSMGO). Vessels are generally expected to return to port to bunker, although may occasionally bunker at sea. Vessels routinely discharge a variety of wastewater streams to the marine environment including ballast, sewage, greywater, food waste, cooling water, brine, bilge; and some vessels may also incinerate solid wastes.

Shell has contracted supply vessels that will support Prelude activities during normal operations, with additional vessels as required for planned campaigns. The MPSV can also be called to respond to subsea inspection and intervention requirements.

6.10.7.4 IMR Vessels

Vessel IMR activities could occur at any time during the petroleum activity. Vessels used are expected to range between 30 and 130 m in length. Vessel type and specifications will depend on availability and specific activity requirements. Most vessels will operate using dynamic positioning (DP). Inspection vessels conducting marine acoustic surveys will not be required to be DP vessels; however, neither will they anchor while conducting the petroleum activity. Lifting and transfer of equipment and supplies between vessels may be required in the activity area and crew transfers may be undertaken by helicopter or vessel to vessel.

6.10.7.5 Accommodation Support Vessel (ASV)

An ASV may be required during turnarounds (approximately every 4 years) to provide temporary facilities for personnel. The supporting ASV will use DP to maintain its relative position to Prelude and will be equipped with a helideck and a motion compensated gangway allowing transfer of personnel on and off the facility. During a turnaround, the ASV is either connected directly aft of Prelude (with a secondary landing point on the portside aft of the blast wall to manage SIMOPs) or operating within the 1500 m PSZ (for example, when there are planned offtakes in the lead up to the turnaround, or ASV gangway maintenance is required). Exceptional circumstances may require the ASV to temporarily operate outside the PSZ, such as during a period of air quality concern (hours).

An ASV is planned to support Prelude during the 2026 turnaround for 80 days with six 5-day extension options. Any subsequent turnarounds are likely to be of similar durations (<100 days), however detailed analysis to define the duration can only be undertaken once the scope of the turnaround has been confirmed. A Walk to Work vessel, which is similar but smaller than an ASV, may also be required for ad hoc maintenance campaigns which are lesser in scope, and therefore duration, than a turnaround. Such a vessel would operate similarly to an ASV and would be within the 1500 m PSZ.

Figure 6-11: Indicative Accommodation Vessel (ASV)

Table 6-5: Typical ASV Specification (indicative only depending on contracting strategy)

Detail	Example Specifications
Main engine capacity	Up to 35,000 kW
Engine configuration	Diesel electric
POB	Up to ~500 (base case ~350)
Length overall	100–125 m
Weight (gross tonnage)	27,000–37,706
Operating draft	15–25 m
Dynamic positioning	DP3

Detail	Example Specifications
Tank Capacities	
Ballast	10,168–11,397 m³
Total fuel oil	1,893–2,240 m^3 (largest single tank is 545 m³)
Fresh water	957–1,000 m^3

6.10.7.6 Manning

Prelude's living quarters houses 170 cabins with double occupancy accommodating a maximum of 340 POB; standard operating maximum is 320. Activities are continuous, 24 hours per day, 365 days per year. All crew changes are via helicopter, although in field support vessels are also designed to transfer crew if required via specific landing areas. Vessels and aircraft supporting the activities when outside the Activity Area (e.g. transiting to and from port) are outside the scope of this EP (except where EP requirements or commitments explicitly apply outside the Activity Area). They must adhere to applicable regulations and other relevant requirements not managed under this EP, in addition to the standards that are covered within this EP. Simultaneous operations (SIMOPS) may occur between any activities.

6.10.8 Waste Handling

Process, equipment, parts, consumables, industrial supplies, packaging, domestic and related wastes are expected to be generated during all activities. Food wastes are macerated and discharged overboard. Most waste streams are shipped onshore for processing. When an ASV or other support vessels are on station most domestic wastes will be isolated on those vessels. The facility has space provisions for storing and using waste receptacles on the main deck laydown (hazardous, non-hazardous, recyclable waste storage areas).

Hazardous and contaminated wastes are processed in accordance with the Browse Regional Waste Management Procedure (HSE_GEN_016774). Decontamination of waste may occur on Prelude or onshore.

Radiation equipment in use on Prelude (fixed nucleonic gauges, laboratory spectrometer and industrial radiography equipment) may occasionally require replacement (if required) and will need to be stored, handled, transported and managed by licensed radiation specialists in accordance with the Prelude Ionising Radiation Management Plan. Any mercury accumulated in process vessels or equipment will be drained or removed periodically during maintenance when offline and at low pressure. Mercury waste will be managed by trained personnel and placed in suitable containers for transfer to an approved specialist onshore waste management facility for treatment and disposal. Equipment will occasionally need to be mobilised for solids and liquids wastes removal, such as desanding and filtration equipment.

7 Description of the Receiving Environment

7.1 Planning Area and Subcategories

This section describes the Planning Area, including details of the particular values and sensitivities within that environment that could be affected by the activity (planned and unplanned), as required by regulations 21(2) and 21(3) of the OPGGS(E) Regulations. The Planning Area has been defined as an area where a change to ambient environmental conditions may potentially occur, but it should be noted that a change does not necessarily imply an adverse impact (Table 7-1). The planned activities have been subdivided into specific subcategories to delineate the maximum extent of ecological and social impacts, as described in Table 7-1.

The spatial extent of the receiving environment encompasses the physical, biological, cultural and socio-economic receptors that may be affected by planned and unplanned activities. The majority of the impacts and risks from the Activity occur within or in close proximity to the Activity Area, however some impacts and risks may extend further. The credible worst-case hydrocarbon release scenarios determined by modelling studies are predicted to present the greatest spatial extent of all the impacts and risks identified. The outer boundary of the area that may be influenced by the Activity, identified by the modelling and referred to as the Planning Area, has been used as the outer boundary for the description of the receiving environment. The worst-case hydrocarbon releases during the Activity have a remote likelihood of occurring, and Shell implements a range of controls to ensure such incidents are prevented, and risks reduced to ALARP and acceptable levels. The Planning Area for the combined worst-case credible hydrocarbon spills from the Activity is shown in Figure 7-1 and represents the area potentially affected at low exposure thresholds. Refer to Section 9.14 for additional information on hydrocarbon spill modelling and risk management and associated impact thresholds applied for the assessment.

The description of the environment has been obtained by multiple sources and described further in Section 7.2

The EPBC Protected Matters Report using the Protected Matters Search Tool (PMST) for the Planning Area and subcategories Appendix C was used to identify environmental receptors protected under the Act. The information was used to inform the assessment of environmental impacts and risks presented in Section 9.

Marine and coastal species identified in the Protected Matters Report (Appendix C) are described, with a focus on protected species that are threatened and migratory. It is important to note that the PMST tool uses a discrete grid system to determine protected matters that might be impacted in an area of interest. Therefore, the PMST returns all the protected matters that intersect the same grid cells that are intersected by an area of interest. With marine matters of national environmental significance, a coarser grid resolution is used. This means there is an increased likelihood of “false positives” in marine areas. The results of the updated PMST report were screened against Geographic Information System (GIS) data sets and current literature to determine and remove those sensitivities identified by the report that are outside of the area of interest.

Distances from the Activity Area and Prelude to environmental receptors are provided in the following sections. These are measured from the nearest boundary of the Activity Area or the centre of the Prelude Turret (see Figure 6-5) to the nearest edge of each environmental receptor. As a result, slightly different distances may be reported for what is effectively the same location. For example, various features associated with Cartier Island such as the Sanctuary Zone, habitat critical for survival of marine turtles, Key Ecological Feature, or the island itself will vary slightly in distance.

The Planning Area also overlaps international waters of southwest Indonesia and Timor-Leste and, in the event of a worst-case hydrocarbon spill, there is a 2% probability of hydrocarbons reaching international coastlines in the worst-case spill scenarios (Section 9.14.1.12). These international waters (belonging to Indonesia and Timor-Leste) are broadly comparable to the Australian oceanic waters within the Planning Area, with no remarkable variation in water quality parameters or significant variation in sea state conditions expected. Areas of the Lesser Sunda Ecoregion found within the Planning Area encompass the chain of islands and surrounding waters from Bali, Indonesia to Timor-Leste. The Planning Area also includes a small portion of the southern boundary of the Coral Triangle. The Coral Triangle is located in southeast Asia and the Pacific, and encompasses the tropical marine waters of Indonesia, Malaysia, Papua New Guinea, Philippines,

Solomon Islands and Timor-Leste. It is considered to be the planet's richest centre of marine life and coral diversity (Cross et al. 2014).

Table 7-1: Description of Planning Area and Subcategories

Areas	Description
Description of the Environment	
Planning Area	The Planning Area refers to the zone where ambient environmental and socioeconomic conditions may alter based on planned or emergency events (Figure 7-1). The spatial extent of the Planning Area was determined by combining 300 stochastic oil spill simulations (100 for each season: summer, winter and transition) based on the worst-case hydrocarbon release scenarios modelled. The scenarios include an uncontrolled loss of condensate from a subsea wellhead during operations (LOWC), and losses of diesel, HFO or condensate due to vessel collision during product offloading. The oil spill simulations used to inform the planning area are at the low exposure thresholds for each oil phase, further described in 9.14.1.10 (1 g/m^2 floating, 10 g/m^2 shoreline, 10 parts per billion (ppb) entrained, and 10 ppb dissolved). At low exposure thresholds, a sheen may be visible on the sea surface or shoreline (at ~2 teaspoons of oil per m^2), potentially affecting visual amenity; however, it does not necessarily imply an adverse ecological impact.
Planned Activities	
Activity Area	The Activity Area is defined in Section 6.
Light Assessment Area	The Light Assessment Area is defined as a 104 km radius surrounding the Prelude facility. This area encompasses the maximum extent of predicted potential light impact and is used to identify sensitive receptors and inform the lighting impact assessment (Section 9.4)[6]. The Light Assessment Area is considered conservative, as the predicted spatial extent of light impacts during normal operations from the Prelude facility is limited to a 52 km radius.
Noise Assessment Area	The Noise Assessment Area is defined as 20 km from the Prelude facility. The worst-case extent of the predicted noise impact criteria (based on $SEL_{24}h$ Temporary Threshold Shift [TTS] for low frequency cetaceans) is expected to be met within 20 km of the facility. The Noise Assessment Area is used to identify sensitive receptors and inform the noise impact assessment (Section 9.5).

[6] The Light Assessment Area is overly conservative, exceeding the 20 km suggestion from the National Light Pollution Guidelines for Wildlife (CoA 2023b).

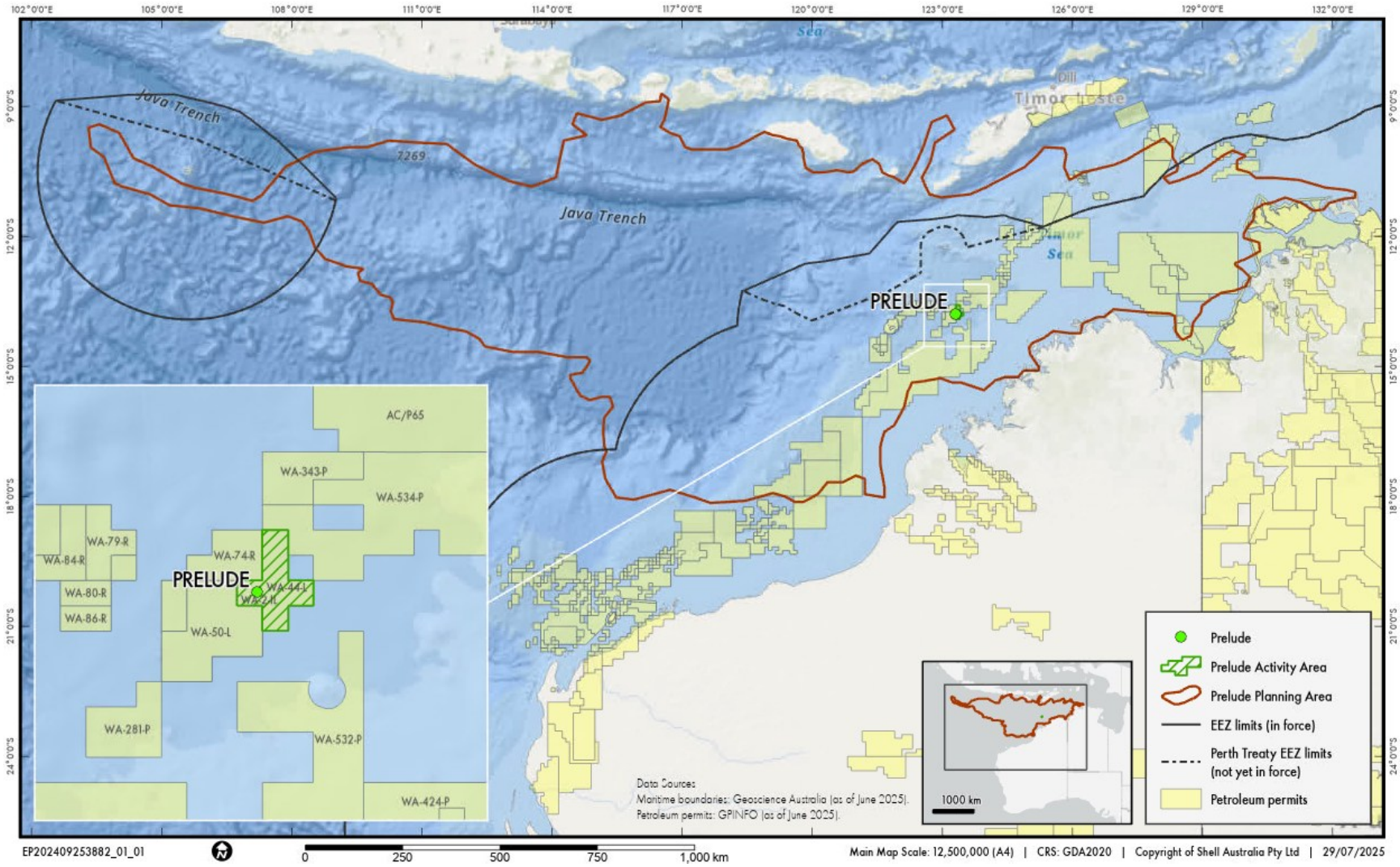


Figure 7-1: Activity and Planning Area

7.2 Information Sources

The detailed description of physical, natural, socio-economic, heritage and cultural features and associated values and sensitivities of the EP was informed by:

- EPBC Act Protected Matters Report (Appendix C)
- stated values in the Marine Bioregional Plans for the North-West Marine Region (NWMR) (DEWHA 2008a)
- stated values in the Marine Bioregional Plans for the North Marine Region (NMR) (DSEWPAC 2012)
- Shell environmental studies (Section 7.2.1)
- relevant publicly available information including published literature and government databases
- information obtained through consultation (Section 5).

7.2.1 Prelude and Crux Development Baseline Studies and Additional Studies

An extensive environmental baseline studies program has been undertaken to characterise the existing marine environment within and surrounding the Activity Area. The studies involved field-based campaigns to capture seasonal variability in the area, as well as desktop modelling studies to contribute to the understanding of the baseline environment. Table 7-2 provides a summary of the relevant environmental baseline studies. Various baseline studies have been completed for Prelude throughout the life of the asset (Prelude FLNG Project EIS, Operate phase) which have been supplemented by the studies undertaken to support the Crux Project.

Table 7-2 summarises the additional relevant Shell initiated environmental, heritage and cultural features studies undertaken to inform the understanding of the environment after the initial baseline studies program.

Table 7-2: Summary of Prelude Environmental Baseline and Additional Studies

Study type	Description of study	Reference
Field-based studies		
Metocean study	Collection of metocean data (e.g. seawater temperature, current, salinity, wave, and wind data) on the surface and through the water column for a 3-year period from September 2007 to October 2010 within and in the vicinity of the Prelude field (F-Block).	RPS Metocean (RPS) 2010
Metocean study	Collection of metocean data (e.g. current, seawater temperature, salinity, wave, and wind data) on the surface and through the water column for a full 12-month period from late April 2016 to early May 2017 within and in the vicinity of the Crux field and along the proposed export pipeline route from Prelude to Crux.	RPS Metocean (RPS) 2017
Sediment, water quality, macrobenthos and plankton communities' study	Sampling and data collection in the WA-371-P title area from 11–19 July 2008 for determination of sediment and water quality, microbenthic, and plankton communities to understand baseline conditions for Prelude.	ERM 2008
Water quality study	Collection of baseline data on physical and chemical components of water quality, along the proposed pipeline corridor from Prelude to Crux field. The surveys were completed over two survey events in April/May 2016 and October/November 2016.	AECOM 2016
Sediment, water quality and infauna study	Collection of baseline data on sediment quality, water quality and infauna communities, along the proposed pipeline corridor from Prelude to Crux field. The study was completed in October/November 2016. Additional baseline data was collected in July 2008 (ERM 2008).	AECOM 2017

Study type	Description of study	Reference
Benthic habitat study	Collection of baseline data to characterise topographic features, benthic habitats and macrofaunal communities, along the proposed export pipeline corridor and within the Crux field, using underwater transects (towed video camera) and geophysical methods (multibeam, SSS, seismic reflection, and sub-bottom profiling). This study was completed in April/May 2017, as part of a combined geophysical and environmental survey scope.	Fugro 2017a
Australian Institute of Marine Science (AIMS) Applied Research Program (ARP)	Shell is an industry partner in support of the AIMS ARP, to develop a comprehensive environmental baseline for waters in the Browse Basin. As part of this project, AIMS is leading a collaborative partnership of trusted research organisations including CSIRO, the University of WA, Curtin University, Monash University and the Western Australian ChemCentre. The ARP research programs of relevance to informing the regional baseline context are: • ARP 2 – Baseline hydrocarbon surveying in the Browse Basin. • ARP 4 – Evaluating the effects of hydrocarbon exposure on non-avian marine wildlife. • ARP 6 – Investigating the breeding and foraging parameters of seabird species in the Browse Basin to determine their vulnerability to impacts associated with potential oil spills, and their ability to recover. • ARP 7 – Subtidal benthos: towards benthic baselines in the Browse Basin.	ARP 2: CSIRO 2017 ARP 7: Heyward et al. 2017a
Prelude Seabed Survey Browse Basin 2008 – Geotechnical results	Gardline Marine Sciences Pty Ltd conducted a geophysical survey and acquired sediment cores at the Prelude development area, off the North-West coast of Australia on behalf of Shell Development (Australia) Pty Ltd during October 2008 to support the initial Prelude EIS.	Gardline 2008
Cetaceans and other marine megafauna study	Vessel and aerial surveys, and acoustic logger monitoring of cetaceans and other marine megafauna in the region undertaken for INPEX Browse Limited (INPEX) and made available to Shell through an information sharing agreement.	RPS 2007
Cetacean surveys	Four 20-day cetacean surveys, conducted by Shell, Woodside and INPEX, to coincide with the expected northern and southern migratory periods for pygmy blue whales through the Browse Basin.	Jenner and Jenner 2009
Underwater noise study	A baseline survey of underwater noise from September 2006 to August 2008 undertaken for INPEX and made available to Shell through an information sharing agreement.	Duncan and McCauley 2008
Desktop/modelling studies		
Produced Formation Water (PFW) modelling study	To quantify the extent of the mixing zones of the PFW discharge (based on field sampling validating dispersion modelling).	RPS 2025a
Liquid Discharges Adaptive Monitoring Study	To assess environmental impacts of Prelude FLNG liquid discharges through a holistic combination of topsides monitoring, PW chemical characterisation, WET testing and field sampling.	AIMS 2025

Study type	Description of study	Reference
Hydrocarbon spill modelling study	To quantify the movement and fate of spilled hydrocarbons that would result from an accidental, uncontrolled release from four determined scenarios that are considered representative of the maximum credible worst-case spills that could result from project activities. The scenarios include an uncontrolled loss of well control from a production well, losses of diesel, HFO or condensate due to vessel collision during product offloading. The study assessed the potential risk to key values and sensitivities from these spill scenarios.	RPS 2025b
Chemical Spill modelling	For the hazardous liquids chemical spill modelling was undertaken using a three-dimensional chemical spill trajectory and weathering model, CHEMMAP (Chemical Mapping and Analysis Program), which is designed to simulate the transport, spreading, entrainment and decay of a unique chemical under the influence of changing meteorological and oceanographic forces. Stochastic modelling was conducted for the worst-case chemical spill including Amine and Meg. The study assessed the potential risk to key values and sensitivities from these spill scenarios.	RPS 2025c
Hydrodynamic model validation study	Data from the metocean study were used to validate the underlying hydrodynamic model used to develop the liquid discharge and oil spill models. The results of the study have been incorporated into the above RPS studies.	RPS 2018e
Light modelling study	To characterise the sources of light emissions from the operation of the Prelude project and assess the predicted impact of light in the context of the nearest sensitive receptors.	Nocterra 2025
Underwater noise modelling study	To predict the effects of underwater noise emissions from the Prelude Operations on key values and sensitivities.	Connell et al. (2025)
Additional studies		
First Nations Underwater Cultural Heritage (UCH) Impact Assessment.	Desktop assessment of the potential presence of First Nations underwater cultural and social values within the Activity Area. First Nations UCH was defined as all tangible and intangible cultural expressions that are associated with and claimed by Indigenous Groups within Australia (past and present) and which occurs in and is attributable to contexts that are now submerged by waters.	Cosmos Archaeology 2023

7.3 Regional Context

7.3.1 Protected Areas

7.3.1.1 Commonwealth Marine Area

The Planning Area occurs within the Commonwealth and WA State Territorial Waters. The Commonwealth Marine Area is defined as any part of the sea, including the waters, seabed and airspace, within Australia's Exclusive Economic Zone (EEZ) or over the continental shelf of Australia, that is not State or NT waters and extends from 3 to 200 nautical miles (nm) from the coast. The Commonwealth Marine Area environment is protected as a Matter of National Environmental Significance (MNES) under the EPBC Act, and its physical, natural and heritage values within the Planning Area are described in Sections 7.5, 7.7 and 7.10 respectively.

7.3.1.2 Marine Conservation Reserves

The Activity Area does not overlap any Marine Protected Areas (MPAs), WA marine parks or reserves and NT marine parks or reserves The Planning Area is within the North Marine Parks Network Plan (DNP 2018) and

the North-West Marine Parks Network (DNP 2018) and Table 7-3 lists the Australian Marine Parks (AMPs) within the Planning Area and these are shown in Figure 7-2. Table 7-4 lists the WA and NT marine parks and reserves within the Planning Area with distances from the Activity Area; these are shown in Figure 6-1. Many marine conservation reserves have management plans that outline the objectives for managing the protected area. Where applicable, Shell considered these in the environmental impacts and risks assessment in Section 9.

Table 7-3: Australian Marine Parks (AMPs) within the Planning Area

AMPs	IUCN Category	Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
Kimberley	Multiple Use Zone (IUCN VI)	The Kimberley AMP covers ~74,469 km^2. The Kimberley AMPs conservation values include the provision of important foraging areas for migratory seabirds, dugongs, dolphins, marine turtles and a migration pathway and nursery areas for humpback whales. The Kimberley AMP ranges in depth from less than 15 m to 800 m and provides protection for the communities and habitats of waters offshore of the Kimberley coastline. There are two KEFs that are represented in the Kimberley AMP (both within the Planning Area)—Ancient coastline and Continental slope demersal fish communities (see Section 7.7.6) (Parks Australia 2023b). The Kimberley AMP supports or is adjacent to recreational and commercial fishing, tourism activities and areas of Native Title claims and determinations (Parks Australia 2023b). Within the Planning Area is a Multiple Use Zone (IUCN VI) (DNP 2018a).	94	113
	Habitat Protection Zone (IUCN IV)		151	166
	National Park Zone (IUCN II)		139	155
Cartier Island	Sanctuary Zone (IUCN Ia)	The Cartier Island AMP covers a relatively small area (172 km^2) and is comprised of a Sanctuary Zone (IUCN Ia). The Cartier Island AMP provides an important area for a number of EPBC Act listed species, including sea snakes, turtles and migratory seabirds. Additionally, it supports some of the most important seabird rookeries on the North West Shelf (NWS) (DNP 2018a).	110	134
Ashmore Reef	Sanctuary Zone (IUCN Ia)	The Ashmore Reef AMP comprises a 550 km^2 Sanctuary Zone (IUCN Ia) and a 33 km^2 Recreational Use Zone (IUCN IV) (DNP 2018). It provides an important area for a number of EPBC Act listed species, including sea snakes, marine turtles, dugongs and migratory seabirds. Ashmore Reef also supports important cultural and heritage sites, such as Indonesian artefacts and grave sites (Parks Australia 2023b). Ashmore Reef AMP is a Ramsar and nationally important wetland (see Section 7.3.1) (DNP 2018).	141	163
	Recreation Use Zone (IUCN IV)		153	175
Oceanic Shoals	Multiple Use Zone (IUCN VI)	The Oceanic Shoals AMP comprises a 71,743 km^2 area, with ~39,964 km^2 designated as a Multiple Use Zone (IUCN VI) (DNP 2018b). The depths range from less than 15 m to 500 m. The Oceanic Shoals AMP supports rich sponge gardens, corals, a diversity of fish life and important resting and feeding areas for breeding marine turtles (Parks Australia 2023a). The	300	326
	Special Purpose Zone (Trawl) (IUCN VI)		522	558

AMPs	IUCN Category	Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
	National Park Zone (IUCN II)	represented KEFs within the Planning Area include Carbonate bank and terrace system of the Sahul Shelf and Pinnacles of the Bonaparte Basin (see Section 7.7.6) (DNP 2018b).	735	760
	Habitat Protection Zone (IUCN IV)		677	698
Argo-Rowley Terrace	National Park Zone (IUCN II)	The 146,003 km^2 Argo Rowley Terrace AMP comprises 108,812 km^2 of Multiple Use Zone (IUCN VI), 1,141 km^2 of Special Purpose Zone (Trawl) (IUCN VI) and 36,050 km^2 of National Park Zone (IUCN II). The depth ranges between 220 m and 6,000 m (DNP 2018). It provides foraging areas for migratory seabirds, loggerhead turtles and sharks and connectivity between the Mermaid Reef AMP. The representative KEFs include Canyons linking the Argo Abyssal Plain with the Scott Plateau and Mermaid Reef and Commonwealth waters surrounding Rowley Shoals (both outside of the Planning Area) (Parks Australia. 2023b).	316	324
	Multiple Use Zone (IUCN VI)		322	503
	Special Purpose Zone (Trawl) (IUCN VI)		503	515
Mermaid Reef	National Park Zone (IUCN II)	The 540 km^2 Mermaid Reef Marine Park is a key area for over 200 species of hard corals and 12 classes of soft corals with coral formations in pristine condition. It is also an important area for sharks, marine turtles, toothed whales, dolphins, tuna and billfish. The marine park also has important nesting and feeding sites for migratory seabirds. Mermaid Reef Marine Park is entirely National Park Zone (IUCN II) and is listed on Australia's Commonwealth Heritage List due to its conservation values (DNP 2018; Parks Australia 2023e).	516	524
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)	The Joseph Bonaparte Marine Park ranges in depth from approximately 5 m to 75 m and comprises a Multiple Use Zone (IUCN VI) and Special Purpose Zone (IUCN VI) to total an area of 8,597 km^2 (DNP 2018b). The marine park provides important foraging area for marine turtles and the Australian snubfin dolphin. The carbonate banks of the Joseph Bonaparte Gulf, a unique seafloor feature typified by enhanced productivity and high biodiversity, falls within this marine park.	579	603

AMPs	IUCN Category	Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
Christmas Island	National Park Zone (IUCN II)	Christmas Island Marine Park covers an area of 277,016 km² and extends from the island's shoreline to the limit of Australian Exclusive Economic Zone (EEZ), approximately 200 nautical miles from shore. The marine park's offshore waters (from approximately 12 nautical miles from shore to the limit of the Australian EEZ) are zoned National Park-IUCN Category II while most of the inshore waters are zoned Habitat Protection -IUCN Category IV. The Park's values include foraging areas for the endemic Abbott's booby, Christmas Island frigatebird and golden bosun and other seabirds that nest on Christmas Island, as well as whale shark feeding areas and southern bluefin tuna breeding habitat. Inshore areas are essential for the Island's land crabs which migrate to the coast to breed and release their eggs into the ocean. Tourism, recreational and subsistence fishing and other activities like boating, diving, snorkelling, kite surfing and kayaking are important socio-economic values of the marine park (Parks Australia 2023c)	1,587	1578
	Habitat Protection Zone (IUCN IV)		1,911	1919

Table 7-4: WA and NT Marine Parks and Reserves within the Planning Area

WA Reserves	Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
WA Marine Park			
Lalang-gaddam	The Lalang-gaddam Marine Park was formed in 2022 from the amalgamation of four marine parks in Dambeemangarddee Sea Country (see also Section 7.10.1.2); the Lalang-garram/Camden Sound Marine Park, the Lalang-garram/Horizontal Falls Marine Park, the North Lalang-garram Marine Park and the Maiyalam Marine Park (DBCA 2022a). The marine park encompasses approximately 13,080 km^2 and includes coastal gorges, estuaries, bays, numerous islands and reefs, and extensive intertidal areas. It contains important foraging and nursery areas for dugongs, turtles, crocodiles, humpback whales, dolphins, sawfish, manta rays, sea snakes and migratory seabirds and shorebirds (DBCA 2022a). The marine park includes Camden Sound, the principal calving habitat for humpback whale group D (Jenner et al. 2001).	182	198

WA Reserves	Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
North Kimberley	The 18,450 km^2 North Kimberley AMP features geomorphologically complex and varied seascapes and marine habitats, including bays and estuaries with mangroves, sandy beaches, coral reefs, rocky reefs, seagrass meadows and sponge gardens. There are in excess of 1,000 islands within the North Kimberley AMP which provide valuable intertidal and subtidal habitats used by manta rays, dugongs, dolphins, turtles, sawfish and seabirds/shorebirds (DPAW 2016).	163	185
Rowley Shoals	The Rowley Shoals Marine Park (approximately 877 km^2) is characterised by complex intertidal and subtidal reefs which support diverse marine fauna, including more than 233 species of coral and 688 species of fish (DEC 2007). The reefs are thought to be a source of recruitment for invertebrates and fish on reefs further south due to conveyance by the Leeuwin Current (DEC 2007).	555	568
Nature Reserves			
Scott Reef	See Sections 7.3.1.5 and 7.7.4.8	138	146
NT Marine Park			
Garig Gunak Barlu	Garig Gunak Barlu National Park includes the entire Cobourg Peninsula, the surrounding waters of the Arafura Sea and Van Diemen Gulf, and some of the neighbouring islands. It covers about 4,500 km^2 (PWCNT 2023). The national park supports a variety of marine habitats such as rocky reefs, mangroves and mudflats, which in turn support diverse and abundant marine life, including reef and pelagic fish species, coral reefs, and seagrass. Seabirds, crocodiles, turtles and dugong are also supported by these waters (NRETAS 2011).	936	956

7.3.1.3 International Marine Parks

7.3.1.3.1 Savu Sea (Laut Sawa) Marine National Park

The Savu Sea (Laut Sawu) Marine National Park (MNP) is located within the Lesser Sunda Ecoregion located to the south of the Coral Triangle and covers approximately 35,000 km^2 (UNEP-WCMC 2023a). It was established in 2009 and has an IUCN Category II status (UNEP-WCMC 2023a). The MNP is split into three management areas: the Pantar Strait Marine Protected Area, the Sumba Strait Marine Area, and the Tirosa-Batek Marine Area.

The Savu Sea MNP acts as a marine corridor and migratory pathway for marine fauna and is also an important upwelling zone in the Indo-Pacific region due to the presence of deep ocean trenches (Perdanahardja & Lionata 2017). The MNP area is a known migration route for several cetacean species, including the blue whale and sperm whale (Huffard et al. 2012). Other cetacean species such as pygmy killer whales, melon-head whales, shortfinned pilot whales and numerous dolphin species (including Risso's dolphin, Fraser's dolphin, common dolphin, bottlenose dolphin and spinner dolphin) are known to frequent the MNP area (Coral Triangle Atlas 2023). Several species of marine turtle, including the green turtle, hawksbill turtle and leatherback turtle have also been recorded in the MNP area (Huffard et al. 2012).

The marine park area covers a range of habitats and species diversity, including:

- 532 corals species which include 11 endemic and sub endemic species
- 350 reef fish species
- Fifteen mangrove species are recorded that represented 9 families of mangrove.
- Ten seagrass species
- Deep-water habitats such as seamounts, deep-water canyons, straits (migratory corridors)
- Large persistent pelagic habitats
- Main migratory corridors and habitats for 14 whale species, seven dolphin's species, and dugong
- Habitats for five sea turtle species (green, leatherback, olive ridley, loggerhead, and flatback) as well as for large marine fauna such as sharks, napoleon, parrotfish and groupers (Savu Sea National Marine Conservation Area undated).

The Savu Sea MNP provides productive marine habitats that support large populations of fish and artisanal and commercial fisheries. It is estimated that 65% of the East Nusa Tenggara regional fisheries production comes from the Savu Sea (Perdanahardja & Lionata 2017).

7.3.1.4 Wetlands of International and National Importance

Sites recognised under the Convention on Wetlands of International Importance (the Ramsar Convention), referred to as Ramsar wetlands, are protected under Part 3 of the EPBC Act and are MNES. Table 7-5 describes the Ramsar and nationally important wetlands identified within or adjacent to the Planning Area (Appendix C) as shown in Figure 7-4. The closest wetland to the activity is Ashmore Reef and is 139 km away.

Table 7-5: Ramsar and Nationally Important Wetlands within the Planning area, including distance from Activity Area

Wetland	Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
International Importance (Ramsar)			
Ashmore Reef Commonwealth Marine Reserve	Ashmore Reef supports an abundance and diversity of birds; 72 species have been recorded at this Ramsar site, with 12 species recorded breeding (Hale and Butcher 2013). Ashmore Reef was designated as a Ramsar wetland based on these characteristics:	139	162

Wetland	Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
	• largest atoll in the region. • managed for conservation purposes since 1983. • each wetland type is in near natural condition, with low densities of coral predators and disease. • its three islands are the only vegetated islands within the Timor Province bioregion. • supports 64 threatened species. • considered a true 'hotspot' of biological diversity within the Timor Province bioregion and within the broader NWMR. • supports 47 species of waterbird listed as migratory under international treaties and three species of migratory turtle (green, hawksbill and loggerhead). • supports breeding of green and hawksbill turtles, dugongs and 20 species of waterbird. • regularly supports >40,000 waterbirds including large numbers of migratory shorebirds and breeding seabirds (Hale and Butcher 2013). Ashmore Reef is also recognised as a KEF and is within the Ashmore Reef AMP (see Section 7.3.1 and 7.7.6).		
Cobourg Peninsula	The Cobourg Peninsula Ramsar site is located in the NT, approximately 163 km north-east of Darwin. The site was the first Ramsar Wetland in the world, designated for its diversity of coastal and inland wetland habitats, support for populations of Endangered species and life-cycle functions (BMT WBM 2011). Wetland types include coral reefs, rocky marine shores, intertidal mud, sand or salt flats, karst, and intertidal marshes. Notably, the majority of the site is terrestrial land, with large areas of Eucalypt-dominated woodlands, and does not support wetland habitat (BMT WBM 2011). Whilst the site contains no towns or settlements the area has been inhabited continuously for at least 50,000 years and therefore has significant cultural characteristics.	937	958
Nationally Important Wetlands			
Ashmore Reef	Ashmore Reef is one of only three emergent oceanic reefs in the north-eastern Indian Ocean, and the only one with vegetated islands. The Ashmore Reef reserve comprises three islets surrounded by intertidal reef and sand flats and deeper subtidal reef and sand flats. Some 95 bird species have been recorded from the reef and its adjacent waters, 43 of which are listed on the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA). The islets are an important staging point for wading birds migrating between Australia and the northern hemisphere (DCCEEW 2023).	139	162

Wetland	Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
Mermaid Reef	Mermaid Reef is the most north-easterly atoll of the Rowley Shoals, which comprises three distinct reef systems arising from depths of between 300 and 700 m along the edge of the continental shelf. It is recognised as a nationally important wetland due to its pristine coral reef ecosystem and high biodiversity (DCCEEW 2023)	516	544
Cobourg Peninsula System	The Cobourg Peninsula, located in the Northern Territory of Australia, is one of the country's most significant wetland areas. The peninsula includes a diverse array of wetland types, such as intertidal mudflats, extensive mangrove forests, freshwater swamps, coastal lagoons, and estuarine systems (DCCEEW 2023).	937	958

7.3.1.5 World, Commonwealth and National Heritage Places

There are no World, Commonwealth or National Heritage Places within the Activity Area. Table 7-6 lists and Figure 7-5 shows the Commonwealth and National Heritage Places within the Planning Area.

Table 7-6: Commonwealth and National Heritage Places within the Planning Area

Listed Place	Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
Commonwealth Heritage Places			
Ashmore Reef National Nature Reserve	The Ashmore Reef National Nature Reserve protects Ashmore Reef, a large platform reef with coral reefs, sand flats and three vegetated islands (DCCEEW 2023). Specific values of this site include: • breeding and foraging habitat for marine turtles. • considered to have the world's greatest abundance and diversity of sea snakes. • habitat for 569 species of fish, 255 species of corals and 433 species of mollusc, as well as species not previously recorded or rarely recorded in Australia. • an important seabird rookery and provides an important staging/feeding area for many seabirds and migratory shorebirds (Environment Australia 2002). • breeding and feeding habitat for a small dugong population (<50 individuals) (DCCEEW 2023).	146	162
Mermaid Reef-Rowley Shoals	Mermaid Reef (see also Section 7.7.4.6) is one of three reef systems, located 30 – 40 km apart, which make up the Rowley Shoals. The shoal consists of a reef flat roughly 500 to 800 m wide, shallow back reefs and a large lagoon. The Rowley Shoals have been described as the most perfectly formed shelf atolls in Australian waters, and the clear, deep water and large tidal range of the atolls are considered rare environmental conditions for shoals (DCCEEW 2023i). The specific values of Mermaid Reef include:	558	535

Listed Place	Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
	• high diversity of marine reef fauna, including corals, fish and marine invertebrates (DCCEEW 2023j) • important area for sharks, marine turtles and toothed whales, dolphins, tuna and billfish • important resting and feeding site for migratory seabirds (DCCEEW 2023j) • regionally significant due to the presence of many species not found in inshore tropical waters of Northern Australia, and species that are close to their geographical ranges (DCCEEW 2023j; DCCEEW 2023i). Includes 216 species of fish, 39 species of mollusc and seven species of echinoderms (DCCEEW 2023i) and is considered a genetic stepping stone between the Indonesian archipelago and reefs to the south (DCCEEW 2023i).		
Scott Reef and surrounds	Scott Reef (see Section 7.7.4.8) is considered regionally important for the following features: • high diversity of marine fauna, including corals, fish and marine invertebrates. • physical characteristics of the reefs create environmental conditions which are rare for shelf atolls, including clear deep oceanic water and large tidal ranges that provide a high physical energy input to the marine ecosystem. • high representation of species not found in coastal waters off WA and for the unusual nature of their fauna which has affinities with the oceanic reef habitats of the Indo-West Pacific, as well as the reefs of the Indonesian region. • important for scientific research and benchmark studies into long-term geomorphological and reef formation processes due to the age of the reef and the documentation of its geophysical and physical environmental characteristics (DCCEEW 2023j).	142	154
National Heritage Places			
The West Kimberley	The West Kimberley is known for its ancient geology, Aboriginal culture, stunning landscapes, and biological richness. The West Kimberley holds extensive history of Aboriginal people who have lived in the area for at least 40,000 years and provides remnant habitats for many native animals and plants which are now absent elsewhere in Australia (DCCEEW n.d.a)	167	171

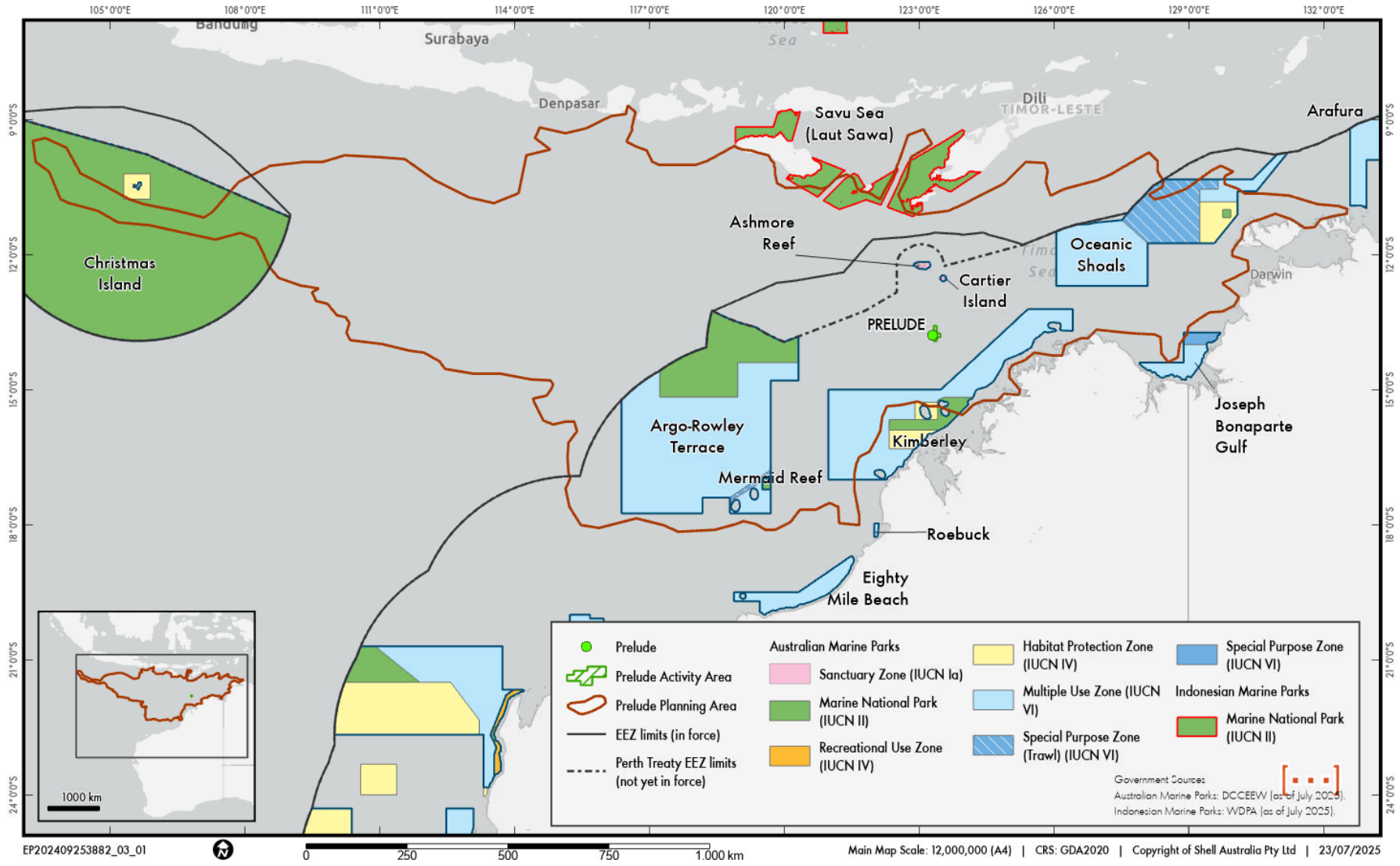


Figure 7-2: Australian Marine Parks within or Proximal to the Planning Area

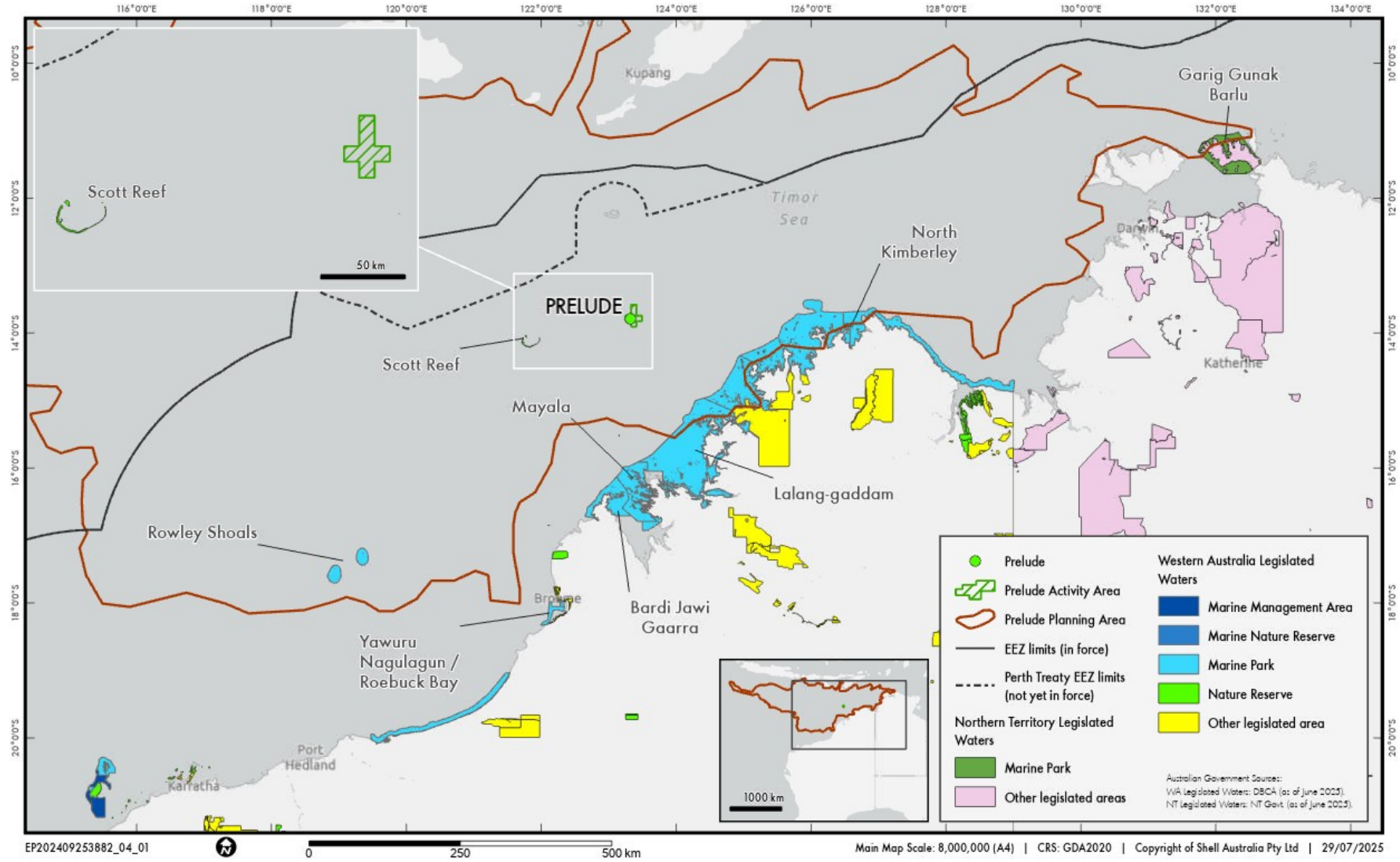


Figure 7-3: WA Marine Parks and Nature Reserves within or Proximal to the Planning Area

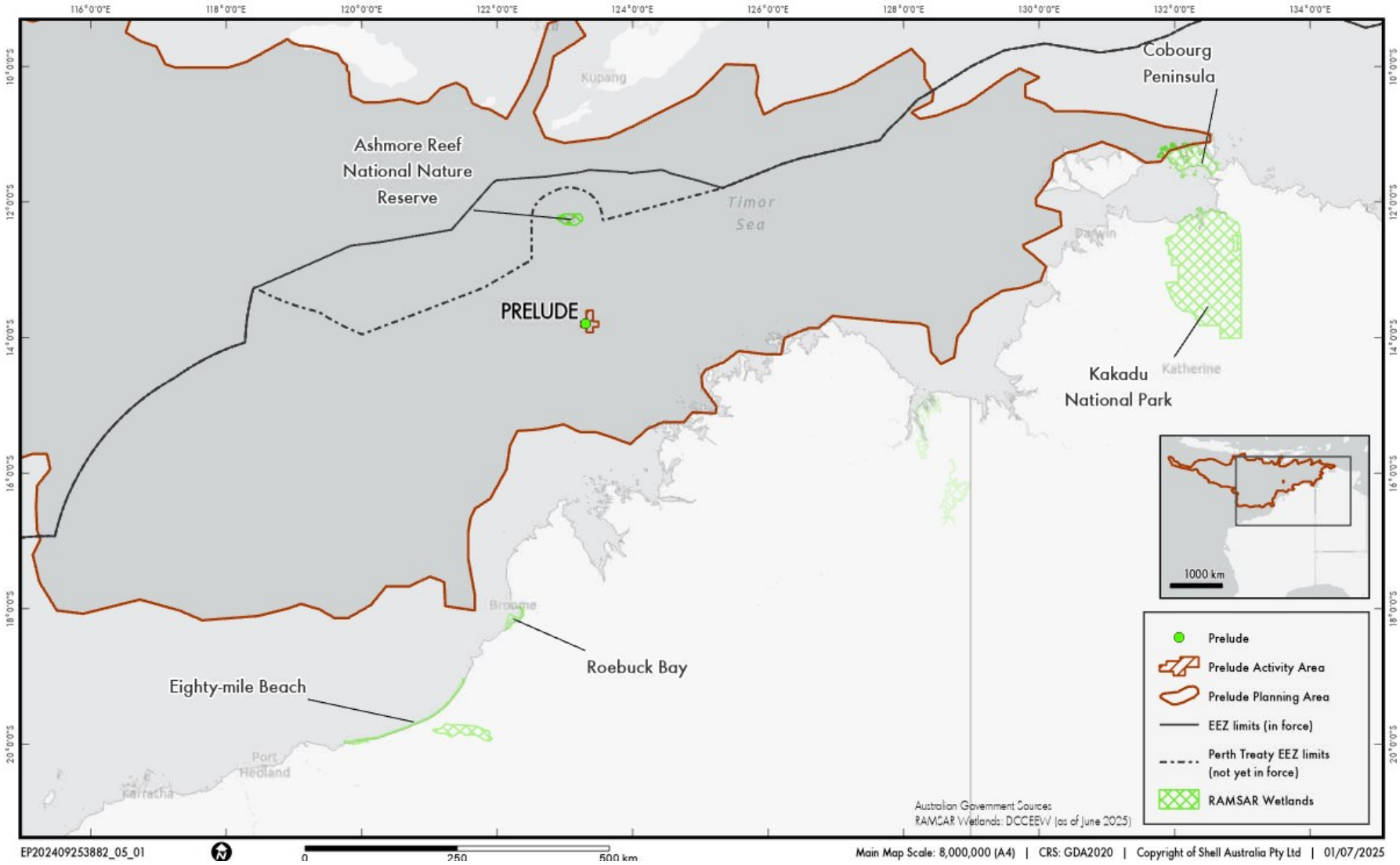


Figure 7-4: Ramsar Wetlands within or Proximal to the Planning Area

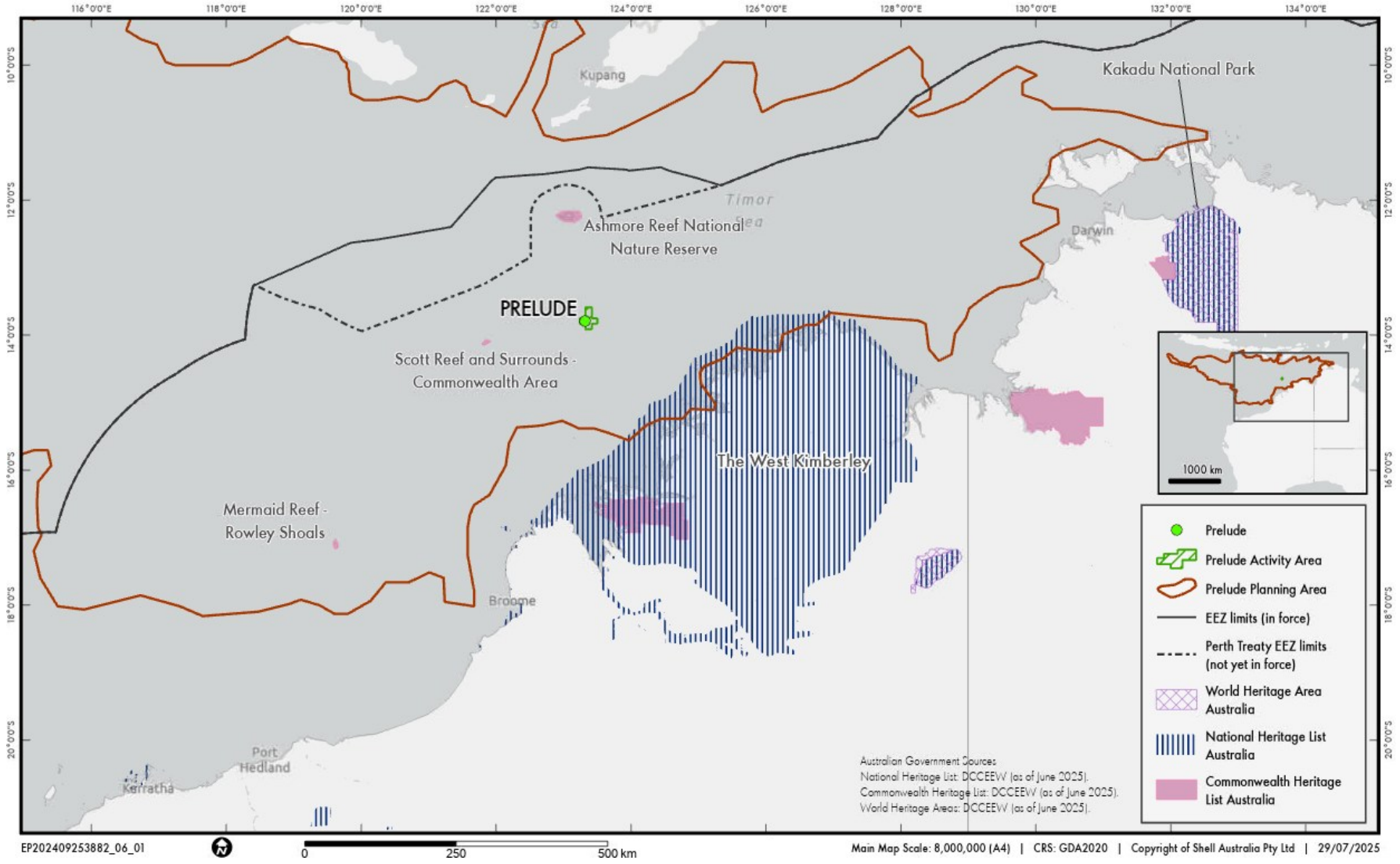


Figure 7-5: Commonwealth and National Heritage Places

7.4 Physical Features

7.4.1 Marine Regions

The Activity Area is located in the North-West Marine Region (NWMR) (see Figure 7-7) while the Planning Area also overlaps the North Marine region. The physical features for each of the regions that fall within the Planning Area as described in the relevant Plans (DSEWPaC 2012a; DSEWPaC 2012b; DSEWPaC 2012i) and are summarised in the following sections.

7.4.1.1 North-West Marine Region

The North-west Marine Region (NWMR) comprises Commonwealth waters extending from the WA–NT border to Kalbarri, WA (DEWHA 2008a). The region is characterised by shallow-water tropical marine ecosystems and home to globally significant populations of internationally threatened species (DEWHA 2008a). The NWMR is further divided into provincial bioregions — the Activity Area is situated within the Timor Province (Integrated Marine and Coastal Regionalisation of Australia [IMCRA] v4.0). The Planning Area overlaps additional provincial bioregions of the NWMR and the North Marine Region (NMR), including the Northwest Province, Northwest Shelf Province, Northwest Transition, Northwest Shelf Transition, Timor Transition, Northern Shelf Province, and Christmas Island Province as shown in Figure 7-7 and described further in Section 7.6.

The main physical features of the NWMR (not limited to the Planning Area) are:

- extensive areas of continental shelf and slope, plateaux and terraces including the Northwest and Sahul shelfs, the Exmouth and Scott plateaux, the Wallaby Saddle, and the Rowley Terrace
- the narrowest continental shelf on Australia's coastal margin, which occurs near Northwest Cape where the shelf is just 7 km wide
- coralline algal reefs, and carbonate pinnacles and shoals in the far north of the region
- coral reefs including Ashmore, Hibernia, Scott, Seringapatam, Ningaloo and the Rowley Shoals, all of which have a high diversity of corals and associated fish and other species of both commercial and conservation importance
- the Joseph Bonaparte Gulf, a muddy basin with sparse coverage of sessile filter-feeding organisms and mobile invertebrates
- a number of major canyons on the continental slope that act as conduits for sediment and nutrient transport, including Cape Range, Cloates, Carnarvon and Swan canyons
- two areas of abyssal plain (Cuvier and Argo) with depths >5000 m
- the Indonesian Throughflow, a low-salinity water mass that is one of the major elements of the global transfer of heat and water between oceans and which plays a key role in initiating the Leeuwin Current.

The NWMR is relatively shallow (<200 m deep over >40% of the region) and strongly influenced by surface currents, notably the Indonesian Throughflow. It is the primary driver of the oceanographic and ecological processes in the region.

The strong seasonality in wind direction and rainfall is another important factor driving ecological processes. The region experiences monsoonal climate patterns with highly variable tidal regimes and a pronounced cyclone season between December and March. The weakening of the Indonesian Throughflow and Leeuwin Current in the dry season (April to September and particularly during El Niño years), along with the seasonal reversal in wind and cyclones, enhances biological productivity through increased mixing of the deeper, cold, nutrient-rich waters with surface waters.

7.4.1.2 North Marine Region

The NMR comprises Commonwealth waters from west Cape York Peninsula to the Northern Territory–WA border (Figure 7-7). The Planning Area overlaps this region eastward as far as the Timor Seas and Croker Island, some of Arafura seas but not the Gulf of Carpentaria or waters off the Queensland coast.

The main physical features of this part of the region are:

- a wide continental shelf with water depths generally less than 70 m, although water depths range from approximately 10 m to a maximum known depth of 357 m
- the Van Diemen Rise, characterised by complex geomorphology with features including shelves, shoals, banks, terraces and valleys like the Malita Shelf Valley, which provides a significant connection between the Joseph Bonaparte Gulf and the Timor Trough
- to the north of the region, a series of shallow canyons approximately 80–100 m deep and 20 km wide that lead into the Arafura Depression, which consists mainly of calcium carbonate–based sediments (e.g. carbonate sand and subfossil shell fragments)
- numerous limestone pinnacles up to tens of km in length and width, which lie within the Bonaparte Basin
- the Arafura Shelf, an area of continental shelf up to 350 km wide and mostly 50–80 m deep that is characterised by sea-floor features such as canyons, terraces, the Arafura Sill and the Arafura Depression
- currents driven largely by strong winds and tides, with only minor influences from oceanographic currents such as the Indonesian Throughflow and the South Equatorial Current
- complex weather cycles and a tropical monsoonal climate, with high temperatures, heavy seasonal yet variable rainfall and cyclones, alternated with extended rain-free periods
- complex tidal regimes, with two tides in some parts, one tide in other parts, huge tidal ranges in some areas and almost no tidal range in others
- high levels of cyclonic activity that are both destructive (loss of seagrass and mangroves) and constructive (run-off from heavy rain mobilises large quantities of sediment into coastal habitats and recharges aquifers).

The NMR is influenced primarily by tidal flows and less by ocean currents. The net tidal flows that occur over time drive longer-term transport patterns through the region. The movement of tidal waters across the northern Australian marine environment is complex due to the barrier of islands and submerged reefs in the Torres Strait that hinder tidal energy entering from the Coral Sea. Currents that have some minor influence in the region include the Indonesian Throughflow and the South Equatorial Current. The Indonesian Throughflow brings warm water of lower salinity from the tropical western Pacific Ocean between the Indonesian islands to the Indo-Australian basin in the north-west of the region. The influence of the South Equatorial Current in the region is marginal, although the strength of its influence varies with the season.

7.4.2 Australian Environment

The term ‘Australian environment’ encompasses the collective receptors (Sections 7.3.1 to 7.10) considered in the context of assessing potential climate change or pests/diseases impacts. This broad definition is employed to incorporate the precautionary principle, acknowledging the inherent uncertainties in the relationship. For example, the contribution of GHG emissions and the effects of climate change to these receptors or the potential introduction and establishment of pests and diseases to Australian waters.

7.5 Physical Values and Sensitivities

The following sub-sections detail the physical values and sensitivities that have recognised measures of acceptable impacts within the Prelude Planning Area. A summary of the studies completed is provided in Table 7-2 with data collected at Prelude and where applicable for the Crux Project.

7.5.1 Air Quality

The Planning Area is located within the remote ocean, distant from anthropogenic air pollutant sources and therefore expected to exhibit generally high air quality. Temporary regional increases in airborne particulates in north-western Australia may result from fires and/or dust storms occurring from Australia or south-east Asian countries (EPA 2007; Vadrevu et al. 2014; Kim Oanh et al. 2018). In offshore areas, commercial shipping and petroleum production facilities may contribute to localised reductions in air quality. Parts of the Planning Area nearer to resource processing/handling sites may also be affected by industrial emissions, which typically include carbon monoxide (CO), oxides of nitrogen and sulphur, and/or ozone (IQAir 2023; EPA 2007).

Shell's Prelude and Crux (once operational) facilities, marine traffic, and other operating petroleum production facilities in the immediate region, such as the Montara FPSO facility and the Ichthys are likely to represent the main sources of localised reductions in air quality in the area.

7.5.2 Water Quality

The marine waters within the Planning Area can be considered pristine, but subject to considerable spatial and temporal variation in characteristics. As a generalisation, offshore waters are frequently clear, oligotrophic, and largely free of anthropogenic influences.

Localised reductions in water quality can be expected around marine discharges associated with industrial developments, including offshore oil and gas facilities.

Natural offshore seeps may locally contribute to hydrocarbon concentrations, with the Browse Basin described as the best-known area of natural hydrocarbon seepage in the marine environment in Australia (Logan et al. 2010). Hydrocarbon seeps have been observed at the Cornea oil field and Heywood Shoals on the northern Yampi Shelf, (Jones et al. 2005; Rollet et al. 2006; Logan et al. 2010), and expulsion of gas bubbles suggesting seep activity observed along the southern flank of the Ashmore Platform, (Stalvies et al. 2017). However, studies for Shell by CSIRO (2017) indicate the abundance of benzene, toluene, ethylbenzene, xylenes (BTEX) and higher molecular weight polycyclic aromatic hydrocarbon (PAH) compounds in the Browse Basin is generally low to very low, and where present likely the byproduct of wildfires.

Further detail of the water quality of the Activity Area, based on surveys conducted for Shell in 2008 (ERM 2008 reported in Shell 2009) and those for Crux in 2016 (AECOM 2016 2017), and with reference to water quality default guideline values (DGV) defined in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018) where relevant, is provided in following sections.

7.5.2.1 Physico-chemical

Water quality in the vicinity of Prelude is generally high. A field survey in 2018 was carried out in WA-371-P (including the now WA-44-L) title area, which consisted of 40 sampling stations within four identified 'impact' zones (A-D) and an outlying 'reference' zone (R). The positioning and extent of impact zones A-C was determined on the basis of the location of the following main operational areas within the proposed facilities layout:

- The sites for the FLNG facility (Zone B)
- The subsea well structures (Zone C)
- Proposed site of subsea infrastructure (Zone A).

The fourth impact zone (Zone D) comprised an area encompassing the above three areas, while the reference sites were located outside the external boundaries of Zone D.

Water samples were collected using Niskin water samples at depths of 5 m (surface), 150 m (mid-depth) and 5 m above the seabed (bottom) for in-situ and lab analyses. Additional in-situ samples were taken at each site at depths ranging from 1 m – 200 m. Upon surfacing, in-situ measurements were immediately collected using a Hydrolab minisonde 5 probe.

Results from this 2018 baseline water quality survey, in conjunction with the Prelude EIS data are presented in Table 7-7.

Table 7-7: Water quality

Parameter	Range value (min – max)	Sample location/ condition
pH Range (min-max)	7.15 – 8.21	In-situ measurement collected in and around the development area. No clear vertical gradient in pH was observed.
Dissolved Oxygen (mg/L)	7.27 - 4.19	DO was found to be same along the sampling point but varied by depth

Parameter	Range value (min – max)	Sample location/ condition
Salinity (Pratical Salinity Units (PSU))	34 - 35 PSU	Averaged data obtained from surface (0 m -10 m). Slightly lower salinity levels recorded in deeper waters.
TSS (mg/L)	Near surface: 3.7 Mid depth: 5.0 Near seabed: 3.8	Data obtained from a study conducted for INPEX in Exploration Permit WA-285-P (RPS 2007) located immediately adjacent to WA-371-P. Turbidity is consistently low throughout the water column, which can be expected for offshore marine environments (Shell 2009)

Water quality in the immediate vicinity of the Prelude FLNG facility is slightly lower due to routine discharges from the facility (e.g. greywater, sewage, PFW etc.). The area impacted by these discharge streams is localised; refer to Section 9.10 for further information.

Temperature, salinity, pH, and dissolved oxygen (DO) recorded in the Activity Area are relatively consistent across sites and comparable to ranges measured by other studies in the region, including Ross et al. 2017, INPEX 2010, CSIRO 2017 and ConocoPhillips 2018. As with other regional surveys, there was evidence of spatial and seasonal variation in some parameters.

Surface temperatures (up to 10 m depth) range between ~30° C to 31° C (AECOM 2016 2017), decreasing to a minimum of ~16° C at 250 m deep (Shell 2009). A distinct thermocline was recorded in the Prelude development area, but this was relatively indistinct during sampling near Crux.

Average DO percent saturation was higher in the upper water column and decreased consistently with depth to the seabed. Average surface DO percent saturation ranged from ~86–109%, with DO near the seabed ranging between ~41% to 56%. The high levels of DO in surface waters is consistent with mixing in the upper water column.

7.5.2.2 Hydrocarbon and Metals

Hydrocarbon and metal concentrations in waters of the Prelude and Crux development areas are generally below laboratory detection levels and/or default guideline values (DGV) in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018 (ANZG 2018) as found in baseline studies for Prelude (ERM 2008). Little spatial or vertical variation was observed in seawater for barium, nickel, iron, zinc and cadmium concentrations (ERM 2008).

Zinc was detected at levels above the 99% species protection DGV by sampling at Crux (AECOM 2016 2017) and cadmium and longer chained total petroleum hydrocarbons were recorded in some water samples at Prelude (Shell 2009). The sources of these contaminants are unknown, but, at least for some zinc detections, sampling or laboratory cross contamination may have been involved (Shell 2020).

7.5.2.3 Nutrients and Photosynthetic Pigments

Nutrient concentrations, including nitrite and nitrate, total nitrogen, total phosphorus, and Total Kjeldahl Nitrogen (TKN) are low at Prelude, as are levels of photosynthetic pigments, consistent with the generally oligotrophic nature of offshore NWS waters. Limited seasonal or spatial variation in these properties was apparent from sampling surveys (Shell 2009).

Nitrite/nitrate and total nitrogen concentrations generally increase with depth. Nitrite and nitrate range from typically below detection levels at the surface to mean concentrations of 0.20 mg/L at 150 m and 0.31 mg/L at ~250 m. Mean total nitrogen concentrations increase from below detection levels to 0.18 mg/L at 150 m and 0.3 mg/L at ~250 m.

7.5.3 Sediment Quality

Sediments in the Planning Area are generally considered to be pristine outside of areas receiving marine discharges from operating facilities, including offshore oil and gas facilities. Within the NWMR, the influence of terrigenous sediments tends to be confined to the coastal boundary and in waters less than 100 m water deep, particularly in areas adjacent to rivers (DEWHA 2008a).

Surveys conducted over the NWS indicate that similar sediments occur extensively over this geographic region, but with spatial variation in the grain size and origin of the surface sediments. Sediments generally become finer with increasing water depth, ranging from sand and gravels on the shelf to mud on the slope and abyssal plains (DEWHA 2008a).

Further detail of the sediment quality of the Activity Area, based on surveys conducted for Shell in 2008 (ERM 2008 reported in Shell 2009) and for Crux in 2016 (AECOM 2016; 2017), and with reference to DGV from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality where relevant, is provided in the following sections. A Prelude specific summary is presented below.

Sediments at Prelude are described as very soft carbonate silts to a depth of about 10 m below the seabed. A field survey was undertaken within the same spatial extent as described above in Section 7.5.2 for sediment quality testing. Sediment samples were collected using a Van Veen benthic grab sampler with 0.1 m^2 sample capacity. The average water depth at each sampling station was approximately 240 m. Baseline studies showed concentrations of potential contaminants, such as hydrocarbons and metals, were typically low and similar to other studies in the region (Ross et al. 2017, Shell 2009), survey results are listed in Table 7-8 and survey locations in relation to the Prelude FLNG are in Figure 7-6.

Table 7-8: Prelude Baseline Sediment quality results

Parameter	Value	Sample location/condition
Particle size distribution	Samples from Zones A-D were primarily of silt (56.75% ± 9.06) and clay (29.89% ± 4.22).	In-situ measurement collected in and around the development area
Total Organic Carbon (% wt)	0.06 – 2.9	This concentration is considered as a low percentage range of organic material. Also, there was no clear spatial pattern in mean total organic carbon concentrations between sampling zones.
Oil & Grease (mg/kg) *	C_6 – C_9: 5 C_{10} – C_{14}: 114 C_{15} – C_{28}: 203 C_{29} – C_{36}: 50	Levels of oil and grease above the limits of reporting (200 mg/kg) were found only in one sample from the site of the FLNG facility (Zone A: 3400 mg/kg) and two samples from the reference zone (Zone R: 530 and 1660 mg/kg). The Prelude turret location is located at the sediment sampling point D5.
Heavy Metals	Barium: 14.2 – 204 Chromium: 11- 16.5 Iron: 3,205 – 5,830 Nickle: 8.9 -11.2	Concentrations of cadmium (Cd), lead (Pb) and mercury (Hg) were below the laboratory detectible level

** mean concentration of all sample points*

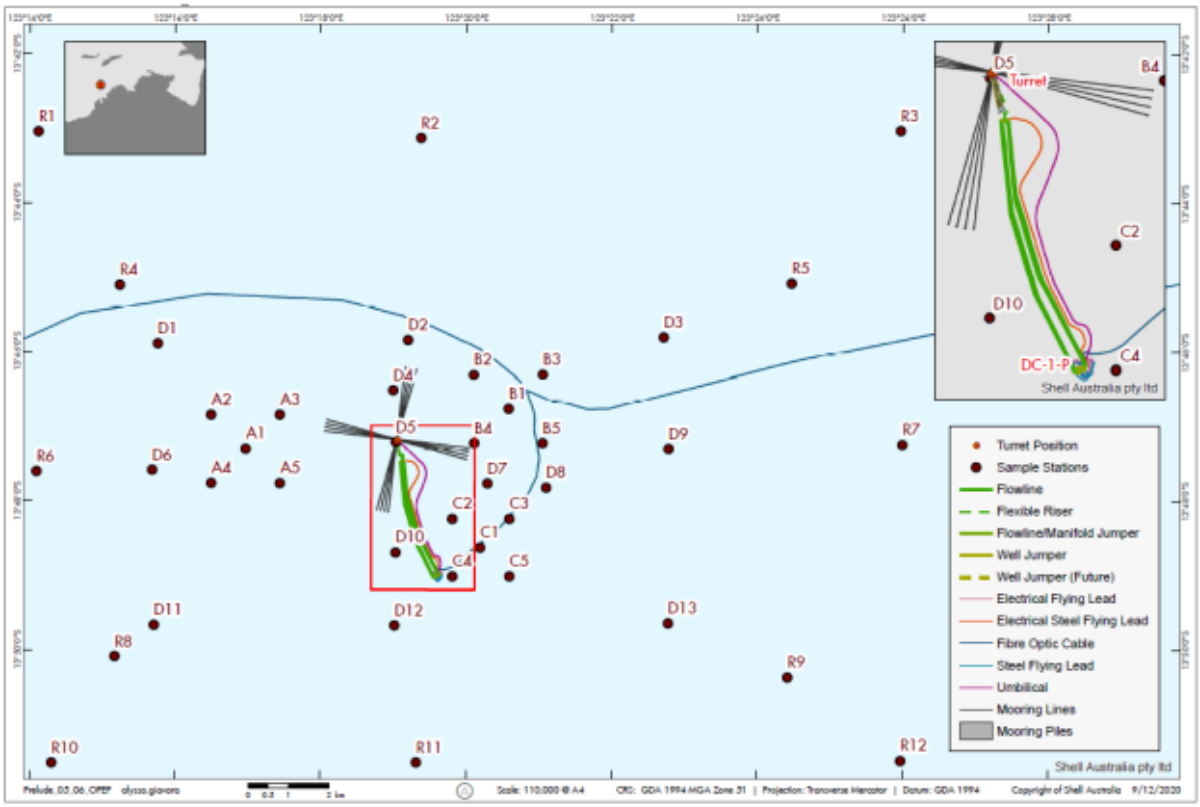


Figure 7-6: Prelude FLNG Baseline Sediment Sampling Locations from 2008

7.5.4 Underwater Noise

Noise in the marine environment is generated by both natural and anthropogenic sources.

Natural noise sources include those produced by wind, waves, currents, rain, earthquakes, echo-location and communication noises generated by cetaceans and fish. Natural background noise levels have been recorded as ranging between 90 decibels (dB) to 110 dB (re 1 micropascal (µPa)), representing the typical range for calm to windy conditions, though heavy rain can result in higher noise levels (Shell 2009).

Anthropogenic sources of underwater noise include shipping, marine construction (e.g. dredging, drilling) and marine acoustic signals, notably seismic airguns but also sonar, sidescan and bathymetric surveys.

Baseline noise monitoring undertaken by INPEX for the Ichthys project, located ~17 km to the south-west of Prelude FLNG, recorded average ambient noise levels of 90 dB (re 1 µPa) under low sea states (INPEX 2010). Baseline noise monitoring for the proposed Barossa Gas Project, ~873 km north-east of the Prelude, observed average ambient sound levels ranging between ~97 dB and 119 dB (re 1 µPa) (ConocoPhillips 2018).

The Prelude underwater noise monitoring program recorded both natural and anthropogenic sources (INPEX 2010), including:

- several regular fish choruses (i.e. schooling fish calling en masse)
- several great whale calls including humpback song, a possible great whale signal, pygmy blue whale signals and possible minke whale signal
- persistent vessel noise
- noise associated with the operation of the Prelude Facility.

The biological noise sources recorded in the Ichthys field were similar and included regular fish choruses, infrequent calls from nearby fish and several whale calls from humpback whales, pygmy blue whales, minke whales and other unidentifiable species (INPEX 2010). Anthropogenic noise sources recorded included low

frequency noise from vessels and that generated from seismic surveys being conducted in the region (INPEX 2010).

7.6 Natural Features

The Planning Area overlaps (Figure 7-7) these marine bioregions:

- Timor Transition (Section 7.6.1)
- Northern Shelf Province (Section 7.6.2)
- Northwest Shelf Province (Section 7.6.3)
- Northwest Shelf Transition (Section 7.6.4
- Northwest Transition (Section 7.6.5).
- Timor Province (Section 7.6.6)
- Northwest Province (Section 7.6.7)
- Christmas Island Province (Section 7.6.8).

The natural features of each of these bioregions as described in the relevant Bioregional Profiles (DEWHA 2008a; 2008d; 2008e; 2008f) are summarised below[7]. There is no published profile for the Christmas Island province and information describing the natural features of these provinces has been sourced from studies undertaken to support the management planning process. Features within the Planning Area that have particular significance, such as species listed as threatened or migratory under the EPBC Act, are described in greater detail as values and sensitivities in Section 7.7.

Section 7.7 describes the natural values and sensitivities associated with natural features that have particular significance within the Planning Area.

7.6.1 Timor Transition

The Planning Area intersects a very small portion (<1%) of the Timor Transition. Pelagic species are prominent in the open water environment of the Timor Transition and many of the pelagic fish species that inhabit the provincial bioregion also have pelagic larval stages. Pelagic species found within the troughs of this provincial bioregion include snaggle-teeth fish, hatchet fish and lantern fish. The shelf-edge/slope is believed to support distinct benthic communities associated with cooler water upwellings, as well as whale sharks and an unusual array of threadfin fish species (Polynemidae). Distinct genetic stocks of red snapper (*Lutjanus erythropterus*) are also found in the canyons and channels of the provincial bioregion, and unique fish assemblages have been found on the Lynedoch Bank which lies on the western boundary of the Timor Transition. Marine turtles have been reported to feed in the deeper canyon waters and solitary, cold water corals have been located in canyons and troughs at depths of around 200 m. Relict reefs occur next to drainage channels of the outer slope, probably at sites of local upwellings of cooler, nutrient rich water from the Timor Sea.

Records show that at least 284 demersal fish species (those living on or near the seabed) are found in this provincial bioregion. However, few data are available for the continental slope in the Timor Transition. This provincial bioregion merges with the slopes of Timor and eastern Indonesia, and it is likely there is overlap with Indonesian and New Guinea fauna, although this has not been fully established.

7.6.2 Northern Shelf Province

The Planning Area intersects a small portion (<1%) of the Northern Shelf Province. The Northern Shelf Province extends over the continental shelf from the eastern shore of Melville Island to West Cape York with most of the province, including the Gulf of Carpentaria, outside of the Planning Area (Figure 7-7).

The Northern Shelf Province encompasses important breeding and feeding areas, as well as migratory and dispersal pathways, for marine turtles. Six of the seven species of marine turtles in the world are found in the Northern Shelf Province with breeding sites along the coastal margins adjacent to the provincial bioregion

[7] Citations are generally as cited in the relevant Profile, but included separately in the Reference list of this document

recorded for four species: green turtle, hawksbill turtle, olive ridley turtle and flatback turtle. In particular, the provincial bioregion is notable for supporting a distinct genetic breeding stock of green turtles and a number of the few recorded nesting sites for olive ridley turtles in Australia. Marine turtles feed both in coastal waters and deeper offshore environments, and they regularly migrate hundreds to thousands of kilometres between nesting and foraging grounds within and beyond the region. Dugongs are known to travel long distances across northern Australian waters with seagrasses near coastlines providing important habitat, although the most significant of these seagrass habitats exist within the Gulf of Carpentaria, which lies outside the Planning Area.

The Wessel Islands adjacent to the provincial bioregion are a little different from other island groups found adjacent to the Northern Shelf Province as a number of endemic marine species are found there, and they form a distinct biogeographical boundary for sponge taxa between eastern and western Australia. Species diversity around the island group is believed to be high, owing to the wide range of habitats found there, including coral reefs. In particular, the fish are diverse, although prawns, polychaete worms and molluscs tend to be typical of the region. River dolphins (bottlenose, Australian snubfin, Indo-Pacific humpback), sharks, and breeding populations of three species of marine turtle (flatback, green and olive ridley) are also found in abundance around the Wessel Islands.

The Arafura Shelf supports the eastern-most geographic limits of a number of Indonesian coral species, and a high diversity of coral species found in eastern Australia and Western Australia are also found in this provincial bioregion. The coral reefs and reef margins of the Northern Shelf Province are inhabited by typical northern Australian coral reef fauna including octocorals, sponges, ascidians, gorgonians, anemones, bryozoans, crinoids and reef fish. Submerged reefs also provide breeding and aggregation areas for many fish species including mackerel, mangrove jack and snappers, and offer refugia for sea snakes and top predator species such as sharks. Macroalgae are generally sparse in this provincial bioregion, however phytoplankton blooms have been observed around reefs. These blooms may occur at localised micro-upwellings of nutrients driven by wind and tidal eddies.

7.6.3 Northwest Shelf Province Bioregion

The Planning Area intersects a 27% of the Northwest Shelf Province. The sandy substrates on the shelf within the Northwest Shelf Province are thought to support low density benthic communities of bryozoans, molluscs and echinoids. Sponge communities are also sparsely distributed on the shelf but are found only in areas of hard substrate. Other benthic and demersal species in this bioregion include sea cucumbers, sea urchins, prawns and squid. The benthic and pelagic fish communities of the Northwest Shelf Province are strongly depth-related, indicative of a close association between fish communities and benthic habitats (Brewer et al. 2007). Numerous migratory species (such as humpback whales and whale sharks) travel through this bioregion (Jenner et al. 2001).

7.6.4 Northwest Shelf Transition Bioregion

The Planning Area intersects 72% of the Northwest Shelf Transition. The biological communities of the Northwest Shelf Transition are typical of Indo–West Pacific tropical flora and fauna and occur across a range of soft-bottom and harder substrate habitats. The softer, muddy substrates are thought to be sparsely covered by sessile filter-feeding organisms, such as gorgonians, sponges, ascidians and bryozoans, and mobile invertebrates, such as echinoderms, prawns and detritus feeding crabs. The harder substrates are believed to have a more diverse range of sessile benthos, such as hard and soft corals, gorgonians, encrusting sponges and macroalgae, and consequently, a more reef-associated fish and shark fauna.

Pinnacles and carbonate banks are believed to support a high diversity of marine species. This is thought to be because of the channelling of water around these features, which stimulates enhanced local biological productivity through the stirring of nutrients. In addition, the hard substrates are suitable for the formation of filter-feeding coral and sponge communities.

The formation of carbonate banks in the bioregion is thought to be associated with seafloor hydrocarbon seeps (vents in the seafloor through which hydrocarbons and frequently other chemicals enter the water column). Microbial utilisation of hydrocarbons is thought to create carbonate by-products, which precipitate and form the basis of the banks. The hard substrate is then colonised by reef-building organisms that thrive on passing nutrients. Demersal catch records from the Northern Prawn Fishery in the region indicate that the bioregion's demersal communities have a relatively high biomass and further suggest that the bioregion is an area of high species diversity. There are occasional reports of very large catches of some species, such as the cornflake

or swimming crab (*Charybdis callianassa*), which are believed to be because of spawning aggregations of this species (Brewer et al. 2007). Healthy offshore populations of crustaceans (including prawns) are indicators of inshore biological productivity, but the direct linkages between these species and marine systems are poorly understood. By-catch from the prawn fishery contains a high level of demersal fish. Adjacent to the Northwest Shelf Transition (within the NWMR), the shoals contain species, such as polychaete worms, crustaceans, brittle stars, gobiid fish, bivalves and sipunculans. It is likely that similar species would be found in the region around the banks and shoals of the eastern areas of the Northwest Shelf Transition.

Sea snakes are also known to occur in the provincial bioregion, including EPBC Act threatened species such as the short-nosed, leaf-scaled and dusky sea snakes.

The Northwest Shelf Transition supports a number of protected marine species. A distinct genetic stock of flatback turtles is known to inhabit the Joseph Bonaparte Gulf and adjacent areas of the North Marine Region, and is likely to nest and feed in and adjacent to this bioregion (Limpus 2004) Marine turtles are also believed to feed in the reef habitat of this bioregion, and pinnacles on the mid-shelf may be important feeding sites for green, loggerhead, flatback and olive ridley turtles (Brewer et al. 2007; Donovan et al. 2008). Dugongs are also known to feed on seagrass communities in coastal waters of the Joseph Bonaparte Gulf adjacent to the region.

Predator species in the bioregion include rays, sawfish, sharks and sea snakes. Sea snakes are regularly caught as by-catch in the Northern Prawn Fishery. A number of sites along the Kimberley coastline adjacent to the region are also important for seabirds and cetaceans, including the Indo-Pacific humpback dolphin and the Australian snubfin dolphin, which may be endemic to Australian waters. The Kimberley coast, but particularly the area around Camden Sound, is an important calving area for the West Australian population of humpback whales, from July to November. Humpback whales are also regularly seen up to 50 km offshore between Camden Sound and the Joseph Bonaparte Gulf during winter months. Adele Island is an important breeding area for brown boobies, lesser frigatebirds and small numbers of red-footed boobies, masked boobies and lesser crested terns.

A number of areas provide important habitat for marine species and contribute to the biological productivity of the Northwest Shelf Transition. In particular, deep embayments and islands along the Kimberley coast support extensive tall mangrove forests, tidal mud and sand flats and some rocky shorelines, which provide important nursery habitat for fish and crustaceans. Embayments and estuaries along the Kimberley coastline, including Deception Bay, Talbot Bay, Cape Londonderry, King Sound, Yampi Sound and Cambridge Gulf also support resident populations of inshore dolphins including the Australian snubfin dolphin (Thiele 2008). Coastal mangroves, seagrasses and algal mats also provide important habitat for many marine fish, dugongs and marine turtles. They are also important for nitrogen fixation and nutrient recycling, providing nutrients in shallower waters that may be transported via currents and tides into adjacent Commonwealth waters. Reefs around the coastal islands of the Kimberley, including Montgomery Reef in Collier Bay, contain a high biomass of corals and coralline algae, which are important contributors to biological productivity in this bioregion.

Biogeographically, the Northwest Shelf Transition is a transitional zone between the east and the west of Australia, yet its affinities lie mainly with the Indian Ocean. Marine plant and animal groups are more like those of west coast Australian animal and plant life than that of the east coast of Australia. Cetaceans are not frequently sighted in this provincial bioregion.

Within the coastal and shelf areas of the Northwest Shelf Transition, benthic algae and seagrass communities are confined to the intertidal area adjacent to the provincial bioregion, with high turbidity restricting light penetration in the coastal shelf areas to waters up to depths of 20 m. Two dolphin species that may be endemic to Australia, the Australian snubfin dolphin and Indo-Pacific humpback dolphin, occur in coastal areas and river mouths of the Joseph Bonaparte Gulf. Dugongs and marine turtles move through coastal waters to feeding and nesting grounds adjacent to the provincial bioregion. Coastline and islands adjacent to the provincial bioregion, including Melville Island and Bathurst Island, support one of the highest concentrations of nesting flatback turtles in the world.

Healthy offshore populations of crustaceans (including prawns) are indicators of inshore biological productivity, but the direct linkages between these species and marine systems are poorly understood. Indian banana prawns (red-legged banana prawn, *Fenneropenaeus indicus*) are primarily caught in the Joseph Bonaparte Gulf. By-catch from the prawn fishery contains a high level of demersal fish. Fifteen species of sea snakes are

also known to occur in the provincial bioregion, including the elegant sea snake, olive-headed sea snake, Stokes' sea snake and Dubois' sea snake.

There is a paucity of data available on the biology in the Bonaparte Basin. Benthic animal groups are influenced by depth and the grain size of the surface sediments. Some bacterial production may occur, but deposit feeders are likely to dominate the basin environment. Swimming crabs (*Charybdis callianassa*) are abundant in the basin muds and may be the dominant first order consumers of detritus. These crabs may also be important prey for predatory pelagic fish species found in the vicinity of prawn fisheries in the provincial bioregion.

The carbonate pinnacles in this provincial bioregion include complex hard substrate environments and provide a very different habitat to adjacent muddy basin sediments. These pinnacles are known to offer refugia for a range of species and may support phototrophic organisms (that obtain energy from sunlight), where they extend into euphotic surface waters.

The Van Diemen Rise is distinctly different in morphology and character from other parts of the region and provides habitats for a wide range of marine communities. In a detailed study, Heyward et al. (1997) describe the coral reef communities that are supported by the banks and shoals of the Timor Sea adjacent to this provincial bioregion. Algal beds of Halimeda species are likely to be a dominant biological component of the banks, similar to banks found in the North-west Marine Region. The Halimeda banks sustain a range of invertebrate communities including sponges, soft corals, hard corals, bryozoans, ascidians and other sessile filter feeders. Foraminifera (single-celled planktonic animals with a perforated chalky shell) are a common component of the benthic fauna. Pelagic line fisheries (mackerel) are linked to localised planktonic food webs at upwelling sites at the heads of channels and indicate important trophic linkages with nutrients from localised upwellings. Red snapper (*Lutjanus erythropterus*) are likely to be associated with complex habitats amongst banks and channels. Hard substrate sediments associated with deep channels are likely to support sponges, soft corals and other sessile filter feeders similar to those species found beyond the region. The Van Diemen Rise is also considered to be an important shark habitat and foraging olive ridley turtles have been observed at the banks and shoals.

Adjacent to the Northwest Shelf Transition (within the North-west Marine Region), the shoals contain species such as polychaete worms, crustaceans, brittle stars, gobiid fish, bivalves and sipunculans. It is likely that similar species would be found in the region around the banks and shoals of the eastern areas of the Northwest Shelf Transition Bioregion.

7.6.5 Northwest Transition Bioregion

The Planning Area intersects 80% of the Northwest Transition Bioregion. The benthos of the deep ocean areas of the Northwest Transition is likely to support meiofauna (minute animals living between grains of sediment on the seabed, e.g. nematodes), larger infauna (that burrow into sediments, e.g. polychaete worms and isopods) and sparsely distributed epibenthic communities (that live on the surface of the seabed, e.g. sea pens) (Brewer et al. 2007). Mobile benthic species, such as deepwater sea cucumbers, crabs and polychaetes are likely to be associated with the seafloor, and the bioregion may support sparse populations of bentho-pelagic fish and cephalopods in low densities. Pelagic fish species likely to be present include grenadiers and hatchetfish (Argyropelecus spp.), as well as transient populations of highly mobile pelagic species, such as sharks and schools of small pelagic fish. Adult and juvenile southern bluefin tuna are thought to migrate through this bioregion on their way to and from the commercially important, and only know, spawning grounds for this species, located in an area encompassing Christmas Island's EEZ and extending towards Java, and north-western Australia, covering over one million km^2 and including much of the NWMR . However, the timing of these migrations and the use of regional currents to assist their migration is still unclear. Seabirds are likely to feed on small pelagic fish in this bioregion.

The slope habitat of this bioregion is associated with important populations of demersal fish species. A national bioregionalisation of slope fish communities identified the North West Slope (which occurs in this bioregion, as well as the adjacent Timor Province) as supporting the second richest demersal fish assemblage nationally (Last et al. 2005). Over 508 fish species have been identified on the slope in this area, and 64 of these species are endemic. Demersal slope fish species in this bioregion are distributed across a number of distinct depth ranges on the slope, specifically areas of the upper slope (225–500 m) and mid slope (750–1,000 m). The high diversity and endemism of the demersal fish fauna indicate important interactions between physical processes and trophic structures in this bioregion.

The Rowley Shoals are a hotspot for biodiversity in this bioregion and contain intertidal and subtidal coral reefs. These reefs support a diverse marine fauna typical of oceanic coral reef communities of the Indo–west Pacific. The reefs are important stepping stones in the maintenance of gene flow among the north-west Australian coral reefs. Biological surveys of the reefs have identified 184 species of corals, 264 species of molluscs, 82 species of echinoderms and 389 species of finfish (DEC 2007).

Mermaid Reef Marine National Nature Reserve consists of a reef flat 500–800 m wide, that shelves into shallow back-reefs rich in corals and a large lagoon up to 20 m deep. Clerke and Imperieuse reefs also contain lagoons, but they are much shallower and generally more structurally complex as a result of erosion channels cutting through the surface of the terrace (Brewer et al. 2007). The steep change in slope around the reefs attracts a range of migratory pelagic species, including cetaceans, tuna, billfish and sharks. Mermaid Reef supports a variety of shark species, particularly large deep-water sharks (e.g. grey reef shark *Carcharhinus amblyrhynchos* and silvertip whaler shark *Carcharhinus albimarginatus*) which have been adversely affected through overfishing at other reef locations in the North-west Marine Region (Meekan et al. 2005).

7.6.6 Timor Province Bioregion

The Timor Province Bioregion sits fully within the Planning Area. Surveys in the Activity Area show a diverse but low abundance of plankton communities, with phytoplankton and zooplankton assemblages generally consistent with those recorded in the region's offshore waters (Shell 2009, 2020).

Phytoplankton abundance was also very low at Prelude, with key groups identified by sampling including dinoflagellates (*Dinophyceae),* diatoms *(Bacillariophyceae)* and *Prasinophyceae.* The most abundant species included *Prasinophyte sp. (Prasinophyceae); Gyrodinium sp.* and *Heterocapsa sp. (Dinophyceae); Pseudonitzschia sp., Cylindrotheca closterium, Chaetoceros sp., Thalassionemafrauenfeldii sp. and Nitzschia longissimi sp. (Bacillariophyceae)* (Shell 2009).

Zooplankton assemblages were only sampled at the Prelude location and present at low densities, primarily dominated by copepod species (Shell 2009); however, a few samples were dominated by euphausiids or chaetognaths. A diverse fish larval assemblage was also recorded. Although the fish larval composition was primarily dominated by neritic species with little or no commercial value, larvae of the commercially targeted Berycidae (alfonsinos), Carangidae (jacks, trevallies), Lutjanidae (snappers), Serranidae (cods), and Scombridae (tunas, mackerels) were also present. The variety of geomorphic features in the Timor Province, together with its varying bathymetry, results in several distinct habitats and biological communities, many of which occur in close proximity. For example, shallow reefs on the shelf break occur in close proximity to adjacent deep water muddy seabeds on the slope (Brewer et al. 2007). The reefs and islands of the bioregion are regarded as biodiversity hotspots and include a range of important pelagic and benthic ecological communities.

The deep-sea seabed (400 m to 600 m) within the Browse development area, ~160 km northeast of Prelude, was observed as comprising fine sand and silt with epibenthic fauna limited to isolated bryozoan colonies, brittlestars (including basketstars) and sea anemones (Woodside 2014). The most abundant infauna recorded were polychaete bristleworms, accounting for 53.4% of all infaunal assemblages (Woodside 2014).

Macrobenthos in the Prelude development area was also recorded as having consistently low abundance and similar composition across the area surveyed (Shell 2009). Eighty percent of individuals were identified from nine different Phyla (Annelida, Chordata, Cnidaria, Crustacea, Echinodermata, Mollusca, Nematoda and Sipuncula).

The seabed within the Ichthys field (235–275 m), ~ km from Prelude, was characterised by bare substrates supporting an infauna dominated by polychaete worms and crustaceans and few epibenthic organisms. Areas of hard substrate exhibited a low cover of epibenthic fauna, comprising filter feeding communities including sponges, gorgonians and soft corals (INPEX 2010).

Ashmore Reef is characterised as a scleractinian coral reef. It is a significant breeding area for green turtles and has a high coverage of seagrass that supports a small dugong population. Ashmore is also internationally recognised for its abundance and diversity of sea snakes (Guinea 2007), including EPBC Act listed threatened species such as dusky, leaf-scaled and snort-nosed sea snakes. Ashmore Reef and Cartier Island are important staging posts for migratory shorebirds and support some of the most important seabird rookeries in the NWMR.

Scott and Seringapatam reefs are also scleractinian coral reefs and are regionally important for their high biodiversity. They represent the limit of the geographic range of many fish species, including Indonesian species that are not found anywhere else in Australia. In addition, the reefs are the only known habitat in WA for many sea snakes, including the dusky sea snake, fish, molluscs and echinoderms. Scott Reef also supports a small but genetically distinct breeding population of green turtles and is an important staging post for migratory shorebirds. It is also thought to be a foraging area for seabirds, including roseate terns, lesser frigatebirds, brown boobies and wedge-tailed shearwaters (Donovan et al. 2008). There are thought to be highly diverse deep coral water habitats around Scott Reef that are not found elsewhere in Australian waters.

The species composition of all the hard coral reefs in the bioregion is very similar and reflects strong links with Indo–West Pacific fauna, largely as a result of the dispersal of coral spawn via regional currents. The reefs and islands in this bioregion are thought to be important biological stepping-stones between centres of biodiversity in the Indo–Pacific and reef ecosystems further south. There is no significant endemism among the corals of the eastern and western coasts of northern Australia. However, there is greater endemism in biological communities, such as sponges and molluscs, whose larvae are generally not transported long distances by ocean currents. For example, a large component of the sponge fauna of Scott Reef is unique to Scott Reef and does not occur at Seringapatam, despite the close proximity of the two reefs and their connection via regional currents.

Coral reefs in this bioregion support a high biomass of fish species, including tropical reef fish, small pelagic fish, parrotfish and groupers, as well as larger species such as trevally, coral trout, emperors, snappers, dolphinfish, marlin and sailfish. These reefs and their surrounding waters are important habitats for cetaceans and seabirds.

The biological communities of Ashmore, Cartier, Scott and Seringapatam reefs are well understood compared with those of the slope and abyssal plain. Despite their ecological importance, reefs represent only a small proportion of the habitat types that occur in the Timor Province. Based on an understanding of the oceanographic processes that give rise to bursts in biological productivity, it is likely that important demersal communities also occur in the canyons, banks and deep holes of the bioregion, as well as on the Ashmore and Rowley terraces and Scott Plateau.

The North West Slope Trawl Fishery targets scampi in the region. Data from the fishery suggests that muddy sediments in the Timor Province support significant populations of crustaceans (Brewer et al. 2007). In addition, research into the demersal fish communities of the continental slope has identified the Timor Province as an important bioregion because of the presence of a number of endemic fish species and two distinct demersal community types associated with the upper slope (water depths of 225–500 m) and mid-slope (water depths of 750–1,000 m) (Last et al. 2005). This research suggests this bioregion may be distinctive because of the absence of a discrete mid-upper slope habitat, which has been identified in other Australian continental slope bioregions. However, the current understanding of the relationship between demersal fish communities and benthic environments on the continental slope, as well as the trophic relationships of this area, is rudimentary.

A number of migratory species occur in the Timor Province. Migrating whales, including humpback, sperm and blue whales, may ‘ride’ the northward flows of the Eastern Gyral Current and South Equatorial Current en route to breeding grounds off the Kimberley (DEWHA 2008a; 2008b; 2008c; 2008d).

Blue whales reportedly move between Scott Reef and Browse Island during July (northern migration) and again during October–November as part of their southern migration (DEWHA 2008a; 2008d). Whaling records from the 19th century indicate that historically, the number of sperm whales was high in this bioregion. Although their numbers today are unknown, it is possible that they congregate around canyon heads adjacent to the Scott Plateau, attracted by high levels of biological productivity that support aggregations of prey species.

7.6.7 Northwest Province Bioregion

The Planning Area intersects a small portion (3%) of the Northwest Province. The Northwest Province represents the beginning of a transition between tropical and temperate biological communities. The predominantly southward flowing surface currents continue to bring tropical Indo–Pacific organisms into this bioregion, but the presence of the northward flowing Leeuwin undercurrent also transports temperate species from more southern areas (Brewer et al. 2007). North West Cape is a boundary point for a transition in demersal shelf and slope fish communities from tropical dominated communities to the north and temperate

communities to the south (Last et al. 2005). The benthic shelf and slope communities of this bioregion comprise both tropical and temperate species with a north-south gradient. The high endemism in demersal fish species associated with the slope (as has been described for the Northwest Transition and Timor Province) is also evident in this bioregion.

7.6.8 Christmas Island Province

The Planning Area intersects 16% of the Christmas Island Province. Christmas Island is an emergent seamount, bounded by steep sides (except the occasional beach and caves), and a rim of coral growth (O'Hara 2021). The fringing coral reefs that surround Christmas Island contain a mix of coral reef species from both the Indian and Pacific Oceans and over 680 species of fish have been recorded in the region. The overlap of these waters gives rise to varieties of hybrid marine fish and endemic species that are found nowhere else on earth (Parks Australia 2023c). Other important inshore marine habitats include cave systems which support a mix of distinct species.

The offshore waters and habitats of Christmas Island are relatively poorly studied. However, they are known to contain a range of unique seafloor features, habitats and species, particularly seamounts and deep-sea plains. Species like dolphins, deep sea fish and sharks are known to occur (Parks Australia 2023c).

Other marine areas are also considered to be biologically important. These include foraging areas for the endemic Abbott's booby, Christmas Island frigatebird and golden bosun and other seabirds that nest on Christmas Island (Parks Australia 2023c). The island's land crabs migrate to the coast to breed and release their eggs into the ocean during November-January, supporting seasonal aggregations of whale sharks which feed on the crab larvae (Hobbs et al. 2021). The only known spawning ground for the southern bluefin tuna is an area covering Christmas Island's EEZ and extending towards Java, and north-western Australia (Hobbs et al. 2021).

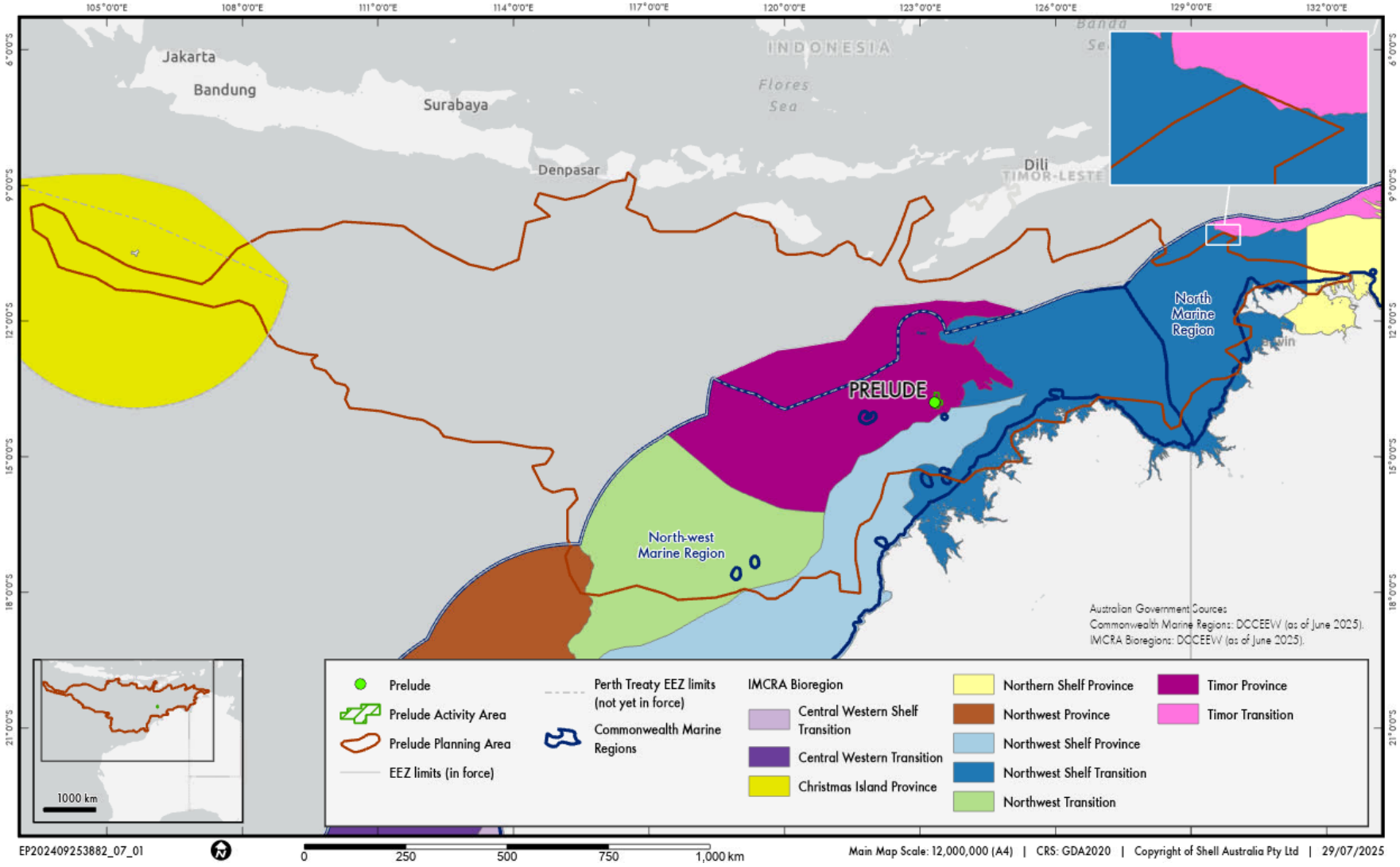


Figure 7-7: IMCRA Provincial Bioregions

7.7 Natural Values and Sensitivities

7.7.1 Biologically Important Areas

BIAs are defined by DCCEEW as "spatially defined areas where aggregations of individuals of a regionally significant species are known to display biologically important behaviours such as breeding, foraging, resting or migration" (DCCEEW 2023e). BIAs provide a tool for defining areas of importance for marine fauna species. The BIAs that overlap the Activity Area and Planning Area are discussed under the relevant species-specific sections in Section 7.7.

7.7.2 Habitat Critical for the Survival of a Species

The Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DoE 2013) define 'habitat critical to the survival of a species' as areas necessary:

- for activities such as foraging, breeding or dispersal
- for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species)
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species.

Such habitat may be, but is not limited to, habitat identified in a recovery plan and/or habitat listed on the Register of Critical Habitat. There are no critical habitats listed on the Register of Critical Habitats within the Planning Area.

The Activity Area does not overlap any areas considered to represent habitat critical to the survival of a species. Section 7.7.10.2 describes the areas considered to represent habitat critical to the flatback turtle, green turtle, leatherback turtle, loggerhead turtle, and olive ridley turtle within the Planning Area.

7.7.3 Shoals and Banks

Table 7-9 lists and Figure 7-8 illustrates the named shoals and banks within the Planning Area, that have recognised environmental value. An understanding of these features has been gained from the Big Bank Shoals study (Heyward et al. 1997), PTTEP surveys initiated in response to the Montara incident (Heyward et al. 2010; Heyward et al. 2012) and the regional shoals and shelf assessment undertaken by AIMS for the Barossa Gas Project (Heyward et al. 2017b). Other studies which have contributed to the scientific understanding of these features include the INPEX Ichthys surveys, those within the surrounds of the Barossa Gas Project area and the Crux Project baseline studies.

The benthic habitats and associated fauna assemblages of these shoals and banks are highly diverse compared to the surrounding relatively deep and bare seabed which constitutes most of the outer continental shelf. These isolated 'islands' of biodiversity may act as important sources of larvae of important taxa such as fish and corals, which may be advected considerable distances. This supply of larvae may enhance recovery of banks, shoals and reefs following disturbances such as cyclones, fishing, and coral bleaching events, and hence may play a role in regional ecosystem resilience (Wahab et al. 2018).

The shoals/banks support many of the same species found on emergent reef systems of the Indo-West Pacific region such as Ashmore Reef, Cartier Island, Seringapatam Reef and Scott Reef (Heyward et al. 2017b). This indicates a high level of ecological connectivity among the reef systems and between the shoals/banks. This is further supported by an analysis undertaken by AIMS which compared benthic habitat community data from a number of shoals/banks within the Timor Sea and Bonaparte Gulf region. The analysis showed that neighbouring shoals and banks frequently share many attributes in terms of benthic community composition and species (Heyward et al. 2017a).

Corals, such as those supported on shoals/banks, are recognised as a key element of reef ecosystems as they provide the structural framework for reef growth (i.e. they are a habitat-forming species), as well as providing important habitat and food source for a vast range of marine organisms, including species of conservation significance (Depczynski et al. 2017). Corals are recognised as providing high ecological value to the marine environment. For example, extensive coral loss can result in declines in habitat and topographical complexity (Sheppard et al. 2002; Graham et al. 2007), which are critical for sustaining high diversity of reef

fishes and other reef-associated organisms (Wilson et al. 2006; Pratchett et al. 2009) (cited in Pratchett et al. 2011). Environmental monitoring following the Montara oil spill has indicated some components of the biological communities of the banks and shoals in the Timor Sea are dynamic, with changes in habitats (e.g. seagrass distribution) and fish assemblages over time.

There is evidence of fishing pressure (particularly illegal fishing such as shark finning) on the banks and shoals in the Timor Sea, with Heyward et al. (2017b) suggesting that this may explain the low abundance of highly prized finfish and sharks. Fishing at banks and shoals may include both subsistence and commercial fishing. While the benthic communities on each shoal/bank reveal a degree of connectivity, the abundance and diversity of dominant benthic species may vary, with subsets of species featuring more prominently on some than others (Heyward et al. 2017b). This variability may reflect different disturbance events (e.g. cyclones, storm damage and coral bleaching) and recruitment histories, as well as potentially different ecosystem trajectories (Heyward et al. 2017b).

Section 7.7.3.1 to 7.7.3.5 describe the shoals and banks within 150 km of Prelude.

Table 7-9: Shoals and Banks within the Planning Area

Feature	Water Depth Range (~m)	Approx. Distance/Direction from the Activity Area	Approx. Distance/Direction from Prelude
Echuca Shoals	10–30	42 km E	62 km E
Heywood Shoals	20–60	65 km NE	84 km NE
Vulcan Shoal	20–180	125 km NE	149 km NE
Goeree Shoal	20–170	125 km NNE	148 km NE
Barracouta Shoals	15–50	128 km N	153 km N
Johnsons Bank	9–30	132 km N	155 km N
Woodbine Bank	12–30	132 km N	154 km N
Eugene McDermott Shoal	20–150	137 km NE	157 km NE
Fantome Shoal	8–20	186 km NNE	208 km NNE
Vee Shoal	30–220	202 km NNE	225 km NNE
Pee Shoal	7–50	252 km NE	278 km NE
Jabiru Shoals	12–200	257 km NE	280 km NE
Mangola Shoal	11–30	274 km NE	298 km NE
Gale Bank	21–50	308 km ENE	328 km ENE
Barton Shoal	13–50	320 km NE	345 km NE
Dillon Shoal	14–30	370 km NE	394 km NE
Karmt Shoal	19–20	392 km NE	418 km NE
Big Bank Shoals	20–300	420 km NE	450 km NE
Echo Shoals	21–100	480 km NE	500 km NE

7.7.3.1 Echuca Shoals

Echuca Shoals are ~62 km east of the Prelude. The shoals are inhabited by diverse and abundant assemblage of reef-associated fishes, sharks, rays and sea snakes, with community structure, species richness and fish abundance mainly driven by depth and hard coral coverage (Heyward et al. 2017a; Moore et al. 2015). The oval shaped reef plateau covers ~11 km^2, with all surveyed epibenthic organisms appearing normal and healthy (Heyward et al. 2017a). With an average depth of 26.1 m, the substrate of Echuca Shoals is 66% rubble, almost half bare (45% bare epibenthic cover) and dominated by hard coral, encrusting organisms and

filter-feeders with 14.2%, 13.3% and 10.4% epibenthic cover respectively (Moore et al. 2017). The same study found Echuca Shoals to have a mean species richness twice that of similar mesophotic (20–80 m deep) coral-reef shoals on the Great Barrier Reef.

7.7.3.2 Heywood Shoals

Heywood Shoals are located ~84 km northeast of Prelude. A detailed survey of the Heywood Shoals fish communities and benthic habitats conducted by the AIMS focussed on the ~31 km^2 of reef plateau, an extended, stepped, gradually sloping platform at depths of 20–60 m (Loya et al. 2019; Heyward et al. 2017a). The study found that the epibenthic organisms appeared normal and healthy, with only limited temporal variability in the nature of seabed and fish biodiversity over the five-year study period. AIMS found the benthic community at the deeper shoal margins to be characterised by mushroom coral species in the family Fungiidae, with hard coral cover highest on the deeper secondary plateau in contrast to shallow platforms characterised by encrusting growth forms (Montipora and Porites) and branching/bottlebrush Acropora. (Heyward et al. 2013, 2017a).

Hydrocarbon seeps have been observed at Heywood Shoals on the northern Yampi Shelf, and fish collected in the vicinity of the Cornea Seep exhibit significant liver detoxification activity, suggesting recent hydrocarbon exposure (PTTEP Australasia 2013).

7.7.3.3 Vulcan Shoal

Vulcan Shoal rises steeply from the surrounding continental shelf, from around 180 m water depth to the plateau of the shoal at ~20-40 m water depth. The shoal plateau is relatively large compared to other regional shoals. Shallower regions around the margin of the plateau host hard coral communities.

The geological origin of Vulcan Shoal appears consistent with other regional shoals by in-situ biogenic sediment production from Halimeda spp. and hard corals the likely sediment sources. Sediments from Vulcan Shoal are predominantly (>80% by mass) sand-sized or smaller (i.e. <2 mm). The grain size distribution is consistent with shoals of similar depth in the region (Heyward et al. 2017a).

Benthic habitats on the plateau of Vulcan Shoal are characterised by mixed biota covering the central part of the shoal, with hard coral habitat concentrated around the margin of the shoal. Habitats in <30 m were characterised by sand, algae and unconsolidated reef. Between 30 and 60 m the relative portion of sand increased, while photosynthetic taxa (algae and zooxanthellate corals) decreased. Of interest, seagrass meadows were observed at Vulcan Shoal in 2010 but had significantly declined by 2011 and had not recovered by 2016 (Heyward et al. 2017a).

While larger in size, the composition of benthic habitats at Vulcan Shoal was similar to other nearby shoals. The fish assemblage associated with the relatively shallow areas with high coral cover include angelfish (Chaetodontidae), butterfly fish (Pomacanthidae) and snapper (Lutjanidae). Shallower areas with less reef cover supported species that were less likely to be site-attached and included trevally (Carangidae), wrasses (Labridae) and scad (Carangidae). Deeper areas with low reef cover supported wrasses (Labridae), houndsharks (Triakidae) and dartfish (Ptereleotrinae) (Heyward et al. 2012).

7.7.3.4 Goeree Shoal

The bathymetric features of Goeree Shoal are consistent with the patterns observed at other shoals and banks in the region, although Goeree Shoal is smaller than Vulcan and Eugene McDermott shoals. Goeree Shoal rises abruptly from the surrounding seabed, with steep sides of the shoal rising from ~170 m to <40 m. The top of the shoal forms a plateau ranging from ~20 to 40 m deep. The western part of the plateau is relatively shallow and is characterised by hard coral communities.

Like other regional banks and shoals, Goeree Shoal is understood to have formed through in-situ biogenic production of sediments, particularly calcareous green algae in the genus Halimeda spp (Heyward et al. 1997). Sediments within and around Goeree Shoal are characterised by sand and gravel fractions (Fugro 2017a). The relatively coarse characteristics of the sediments may be the result of the relatively young geological age of locally produced biogenic sediments (e.g. hard coral rubble or calcareous Halimeda spp. fragments) and potential exposure to relatively fast surface currents that may re-suspend fine sediments. Data presented in Heyward et al. (2017a) indicates sediments at Goeree Shoal are generally coarser than at Vulcan or Eugene McDermott shoals.

Benthic habitats at Goeree Shoal are broadly similar to other regional shoals in a similar depth range. Habitats in <30 m of water are characterised by consolidated reef (and associated turfing algae), sand, hard coral, algae and unconsolidated reef (Heyward et al. 2017b). The relative abundances of these habitats change with increasing depth, with algae and hard corals decreasing in relative abundance in waters around Goeree Shoal between 30 and 60 m depth (Heyward et al. 2012, Heyward et al. 2017b). This is likely to be the result of photosynthetically active radiation decreasing as water depth increases, limiting the depth range of photosynthetic organisms such as algae, seagrass and zooxanthellate corals.

The relatively complex benthic habitats of Goeree Shoal support a diverse fish assemblage compared to the surrounding deeper seabed habitat surrounding the shoal. The greatest fish abundance and diversity is associated with the hard coral habitat found on the western part of the shoal (Heyward et al. 2012). The fish assemblage within this part of the shoal was characterised by species of grouper (Serranidae), damselfish (Pomacentridae) and wrasses (Labridae) (Heyward et al. 2012). The deeper parts of the shoal classified as sparse mixed biota, where hard coral cover is low, were characterised by wrasses (Labridae), houndsharks (Triakidae) and dartfish (Ptereleotrinae) (Heyward et al. 2012).

Analysis of repeated sampling using baited remote underwater video stations at several banks and shoals in the Timor Sea indicated that the cumulative species curves typically do not reach an asymptote. This indicates that these assemblages are likely to be more diverse than has been observed to date (Heyward et al. 2012 2017).

7.7.3.5 Barracouta Shoals

The Barracouta Shoals cover an area of ~5.8 km^2 ~153 km north of Prelude. AIMS' benthic habitat and fish assemblage surveys (2010, 2011, 2013 and 2016) found fish community richness and abundance relatively stable across time at Barracouta East Shoal and a shift in species composition at 30 m depth. Although marked declines in soft coral were noted over the duration of the study, species richness was consistently higher across all years, particularly at shallow depths, when compared to Goeree and Vulcan shoals (Heywood et al. 2013, 2017a).

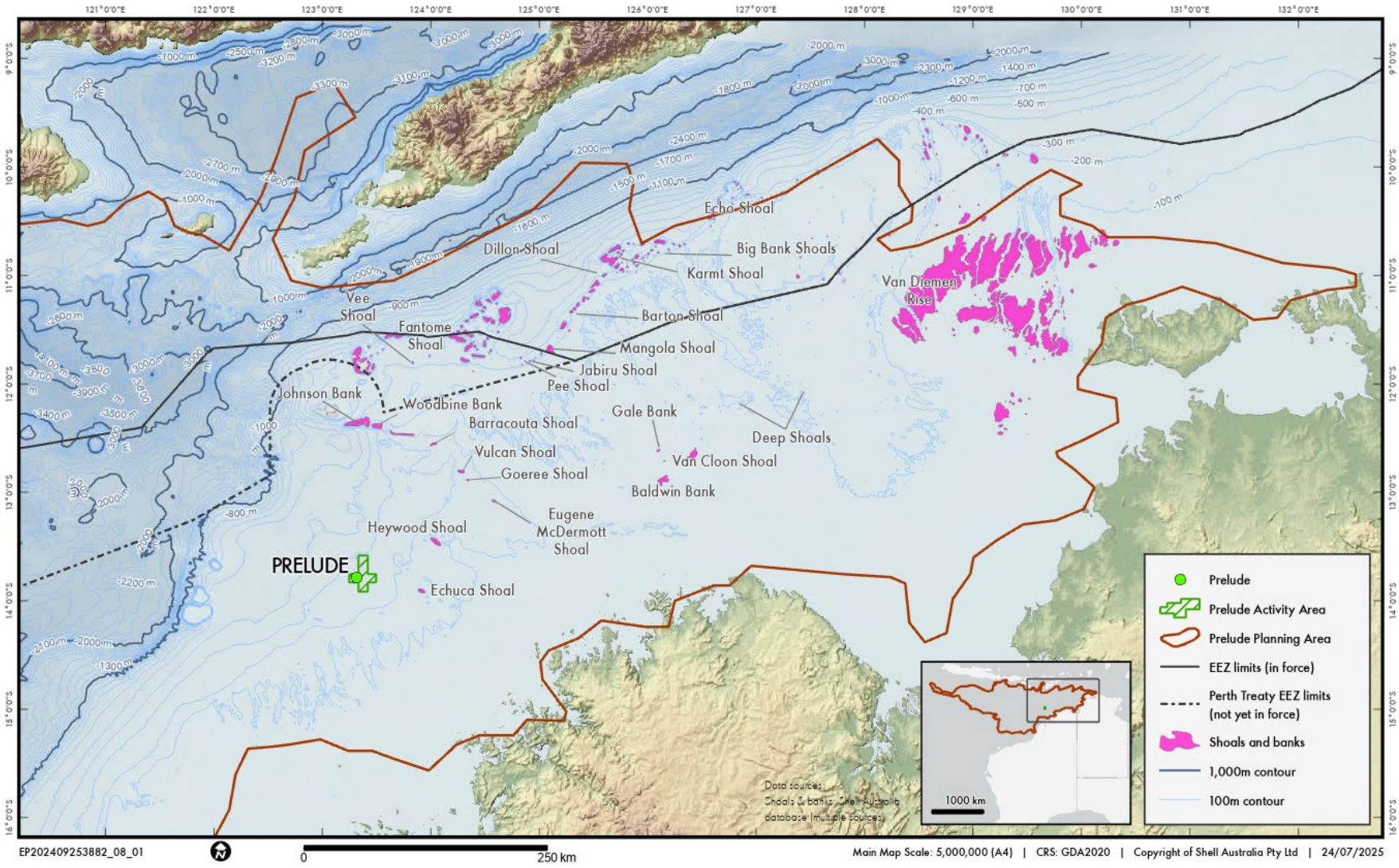


Figure 7-8: Shoals and Banks that are Proximal to or Overlap the Planning Area

7.7.4 Offshore Reefs and Islands

Table 7-10 lists and Figure 7-10 illustrates the offshore reefs and islands within the Planning Area, that have recognised environmental value. Sections 7.7.4.1 to 7.7.4.8 summarise the ecosystem values of the key offshore reefs and islands within the Planning Area.

Table 7-10: Offshore Reefs and Islands within the Planning Area

Feature	Approx. Distance/Direction from the Activity Area	Approx. Distance/Direction to Prelude
Ashmore Reef	141 km NNW	168 km NNW
Browse Island	25 km SE	42 km SE
Cartier Island	110 km NNE	140 km NNE
Christmas Island	1943 km NNW	1950 km NNW
Hibernia Reef	176 km N	200 km N
Rowley Shoals	564 km SW	572 km SW
Seringapatam Reef	130 km W	237 km W
Scott Reef	142 km WSW	147 km WSW

7.7.4.1 Ashmore Reef

Ashmore Reef is protected by the Ashmore Reef Marine Park (Section 7.3.1). Ashmore Reef is also a designated Ramsar wetland of international significance (Section 7.3.1.2) and Commonwealth heritage place.

Ashmore Reef is a large platform reef complex containing an atoll-like structure with two lagoons, large areas of drying flats that become exposed at low tide, shifting sand banks and three vegetated sandy cays: West Island (281,000 km^2), East Island (134,200 km^2), and Middle Island (129,800 km^2) (ConocoPhillips 2018). The surrounding reef consists of a well-developed reef crest and a broad reef flat that can be up to 3 km across. Water depths in the lagoons vary from extremely shallow waters around the sand banks to up to 45 m deep. The three islands within the lagoon are mostly flat, composed of coarse sand with a few areas of exposed beach rock and limestone outcrops (ConocoPhillips 2018; Shell 2009).

7.7.4.2 Browse Island

Browse Island and surrounding waters within 3 nm are WA State Territorial Waters. Browse Island is a sand and limestone cay situated on a limestone and coral reef, covering an area of 0.13 km^2 (Shell 2009). The reef is a flat–topped, oval–shaped platform reef with a diameter of 2.2 km at its widest point (INPEX 2010). The reef complex rises from a depth of ~200 m. The intertidal habitats around the island include (INPEX 2010):

- sandy beaches or coarse coral sand, which is a known turtle nesting site for green turtles
- beach rock, which supports invertebrate fauna
- a lagoon with sand and coral rubble substrates and live corals such as Acropora spp. and Porites spp.
- a reef platform containing areas of sand and coral rubble, limestone supporting sparse algal turf and many barren shallow pools, which is exposed at low tide
- the reef crest, which supports a diverse range of molluscs and hard corals of the Faviidae family (such as Goniastrea spp.)
- a wave swept seaward ramp which supports some algae and coral.

The shallow subtidal zone (<20 m deep) of Browse Island ranges from 50 to 200 m wide and is comprised mainly of bare limestone, with the most diverse coral communities (including Hydnophora rigida, Acropora and to a lesser extent Porites) recorded in raised coral reefs in shallower areas around the island (INPEX 2010). The benthic habitats were noted as characteristic of coral platform reefs throughout the Indo-West Pacific region and limited in their extent in the subtidal region.

7.7.4.3 Cartier Island

Cartier Island and surrounding reefs are protected by Cartier Island Marine Park (Section 7.3.1.1). Cartier Island is an unvegetated sand cay surrounded by a wide platform, that rises steeply from the seabed, and fringing coral reef flats (ConocoPhillips 2018). The coarse sandy beaches of the island support large populations of nesting green turtles.

7.7.4.4 Christmas Island

Christmas Island is located in the Indian Ocean, ~ 2,061 km off the mainland coast. A significant portion (approximately 66%) of the island comprises the Christmas Island National Park, which is managed by Parks Australia. The National Park protects the ~ 80,000 seabirds which nest on the island each year, as well as the abundant and species diverse land crabs, plants and tropical rainforest habitat, and two Ramsar wetlands (see Section 7.3.1.2) (DNP 2014). More than 100 migrant and vagrant seabird species have been recorded on Christmas Island, including nine resident breeding seabird species and 23 vagrant/nonbreeding seabirds (DNP 2014). The island supports a large number of endemic species (254 taxa) due to its isolated oceanic location. The marine environment supports fringing coral reefs, terrace and cave systems, and more than 600 species of fish (DNP 2014). The waters also support threatened green and hawksbill turtles.

7.7.4.5 Hibernia Reef

Hibernia Reef is ~40 km north-east of Ashmore Reef and ~60 km north-west of Cartier Island. The reef is less extensive than that at Ashmore Reef and Cartier Island and is roughly oval in shape, tapering to a point on the western side (ConocoPhillips 2018; Shell 2009). The reef complex contains a deep central lagoon and drying sand flats. There is no permanent land at Hibernia Reef, however, large areas of the reef are exposed at low tide.

7.7.4.6 Rowley Shoals

The Rowley Shoals, located ~ 300 km north-north-west of Broome, comprise three oceanic reef systems (Mermaid, Clerke and Imperieuse Reefs) ~ 30-40 km apart that rise vertically to the surface from depths of between 500 and 700 m. The marine reef fauna of the Rowley Shoals is considered to be exceptionally rich and diverse, including species typical of the oceanic coral reef communities of the Indo-West Pacific. Lying in the headwaters of the Leeuwin Current, the Shoals are thought to provide a source of invertebrate and fish recruits for reefs further south and as such are regionally significant (DEC 2007).

Mermaid, Clerke and Imperieuse Reefs are regarded as the best examples in Australian waters of atolls on the edge of a continental shelf (DNP 2018; DEC 2007). The three reefs are a similar size and shape, each with a shallow lagoon in the middle and sheer vertical drop-offs into deep waters all around. Clerke and Imperieuse Reefs, which lie in State Waters, are protected via the WA Rowley Shoals Marine Park (Section 7.3.1), which covers approximately 87,632 ha. Mermaid Reef lies in Commonwealth waters and comprises the Mermaid Reef Marine Park (Section 7.3.1) managed by Parks Australia.

The Rowley Shoals support extensive intertidal and subtidal coral reefs, exceptionally rich and diverse marine fauna and high-water quality. Imperieuse and Clerke Reefs have sandy cays where white-tailed tropicbirds breed (Parks Australia 2023b). Mermaid Reef is home to over 214 coral species, 530 fish species and a huge array of invertebrate fauna (Parks Australia 2023a). While the coral fauna is similar to Scott Reef, it differs considerably from that of north-western Australia (Veron 1986)

7.7.4.7 Seringapatam Reef

Seringapatam Reef is a remote atoll covering an area of ~55 km^2 and encloses a lagoon of relatively consistent depth of ~20 m (maximum depth of 30 m) (ConocoPhillips 2018). The lagoon is connected to the ocean by a narrow passage in the northeast part of the reef.

Seringapatam Reef is recognised as a KEF (Section 7.7.6). The reef is a regionally important scleractinian coral reef as it has a high biodiversity. Results from the 2006 WA Museum (WAM) survey noted 159 species of scleractinian corals with a hard coral cover of ~16% (WAM 2009). The dominant benthic habitats of the reef have been observed to include turf algae, macroalgae, hard and soft corals, algae and filter-feeders (e.g. sponges, gorgonians, hydroid, seapens) (ConocoPhillips 2018).

7.7.4.8 Scott Reef

Scott Reef is a large oceanic atoll platform that rises vertically from the seafloor in water depths between ~400 m and 700 m and comprises two lagoonal areas (North and South Scott Reef). North Scott Reef is ~17 km long and 16 km wide (Gilmour et al. 2013, Woodside 2014). South Scott Reef is ~17 km long and ~20 km wide. Water depths within Scott Reef vary between 0 m and 80 m, with areas of the reef flat being exposed at low tide. Sandy Islet, a small sandy cay, is the sole permanently emergent land and is ~700 m long and 60 m wide (Woodside 2012). Sandy Islet is a significant nesting site for green turtles, predominantly during the summer months (Gilmour et al. 2013), and it is a foraging and breeding area for a number of seabird species (Woodside 2012).

Scott Reef is recognised as a KEF (Section 7.7.6) and marine park (Section 7.3.1). Coral communities at Scott Reef occur across shallow (<30 m) and deep (>30 m) habitats, with 306 species from 60 genera and 14 families having been identified (Gilmour et al. 2009). Coral communities varied from shallow to deep water with 295 species recorded in shallow water environments and 51 species in deep water. Eleven species were only found in deep water environments. None of the corals recorded were endemic to Scott Reef (Gilmour et al. 2009). Biodiversity at Scott Reef is similar to other regional offshore emergent reefs (e.g. Seringapatam Reef and Ashmore Reef), with the biological assemblages being a sub-set of Indo-Pacific reefs.

7.7.5 Coastal Reefs and Islands

The Planning Area overlaps numerous coastal reefs and islands. Notable amongst these are the reefs and/or islands at the Tiwi Islands, and the Buccaneer and Bonaparte Archipelagos. An overview of these is provided below. In general, those with particular values or sensitivities are recognised through conservation zonings and/or heritage listings; these are also discussed in the relevant sections above (e.g. Section 7.3.1 and Section 7.3.1.2).

7.7.5.1 Tiwi Islands

The Tiwi Islands are comprised of two main islands (Bathurst and Melville Islands) and nine smaller uninhabited islands. The islands are located ~ 80 km north of Darwin. The Tiwi Islands comprise a total area of ~ 8,320 km^2 with a coastline of 1,016 km, and are Aboriginal freehold land owned by the Tiwi Aboriginal Land Trust (NRETAS 2009a).

Due to the isolation of the Tiwi Islands from the Australian mainland, as well as climatic extremes (including high rainfall events), many species found on the islands are not present in the NT (NRETAS 2009a). The diverse array of coastal habitats on the Tiwi Islands includes mangroves, tidal mudflats, sandy beaches, seagrass meadows and fringing reef habitats, as well as eucalypt, paperbark and monsoon vine forests (Tiwi Islands Regional Council 2025). The islands support nesting habitat for marine turtles, internationally significant seabird rookeries, and some major aggregations of migratory shorebirds (NRETAS 2009a). The north coast of the islands is recognised as key areas for the conservation of dugongs and seagrass habitats (PWSNT 2003).

7.7.5.2 Reefs and Islands off the Kimberley Coast

Over 2,500 islands lie off the coast of the Kimberley region of WA, notably in the Bonaparte and Buccaneer Archipelagos. Many of these support seabird aggregations and turtle nesting is also common on islands with sandy beaches, particularly by flatback and green turtles (CCWA 2010).

Troughton Island is a flat island rising 6m above sea level and less than 1 km^2 in area. The island is known to support flatback nesting and seabird breeding (CCWA 2010) and is maintained and used as an emergency airstrip.

The Kimberley has the richest coral fauna, in both species and genera, of any North-West Shelf Bioregion and fringing reefs line the shores of almost all the region's islands (Wilson 2013). Exceptionally diverse coral communities have been documented in the northern Bonaparte Archipelago, with more than 210 species recorded at the Maret Islands (Richards et al. 2015), and it is considered likely that diversity is higher than currently reported (Richards et al. 2017).

Inshore reef communities in the Kimberley are highly divergent from the offshore 'oceanic' reef populations, suggesting that these regions are independent in an ecological and evolutionary sense (Richards et al. 2017).

Coral spawning on inshore Kimberley reefs occurs mainly during autumn, but with second multi-specific spawning also occurring during spring (Gilmour et al. 2016).

An unusual feature of the reefs in the region is the elevation of the reef flats, often with terraces of coralline algae extending up to the mean high tide height (DBCA 2022b). As a result, the reefs are exposed above sea level half of the time and water that collects behind terraces generally forms a shallow, raised lagoon that feeds a series of cascades at low tide. The spectacle of massive structures emerging from the sea and the water cascading off the reef top as the tide rushes out has made Montgomery Reef, the world's largest inshore reef, a significant tourism attraction (Tourism WA 2023; DBCA 2022a).

7.7.5.3 Indonesian Islands

The Planning Area overlaps areas of coastline along the southern coasts of some islands in Indonesia. These include Lombok, Sumba, Sawu and Raijua Island (Figure 7-9). These islands are part of the Lesser Sundra Ecoregion, and some are within the Coral Triangle.

The southern coastlines of the Lesser Sunda Ecoregion of Indonesia and Timor-Leste islands are known to contain sandy beaches consisting of soft black sand, formed by volcanic activity. Within this region, a number of important sites for turtle nesting beaches have been identified (Huffard et al. 2012).

Coral reef communities within the Planning Area are expected to be widespread in shallower waters adjacent to the coastlines of Indonesia and Timor-Leste. The Planning Area overlaps a small portion of the southern boundary of the Coral Triangle. The Coral Triangle is located in southeast Asia and the Pacific, and encompasses the tropical marine waters of Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste. It is considered to be a globally significant centre of marine life and coral diversity (Cross et al. 2014)

Seagrass habitats are widely distributed across the Lesser Sunda Ecoregion and within Indonesian waters the lower intertidal and upper subtidal zones are considered important areas for the growth of seagrass (Hutumo & Moosa 2005). Pioneering vegetation in the intertidal zone is dominated by *Halophila ovalis* and *Halodule pinifolia* while *Thalassodendron ciliatum* dominate the lower subtidal zones (Hutumo & Moosa 2005). Data from the United Nations Environment Program (UNEP) World Conservation Monitoring Centre has identified the southwest and west Lombok, Savu and the south coast of Timor-Leste as potential areas of importance for seagrass (DeVantier et al. 2008).

Mangroves occupy a relatively small area of the Timor-Leste and Indonesian coastlines (Alongi 2013).

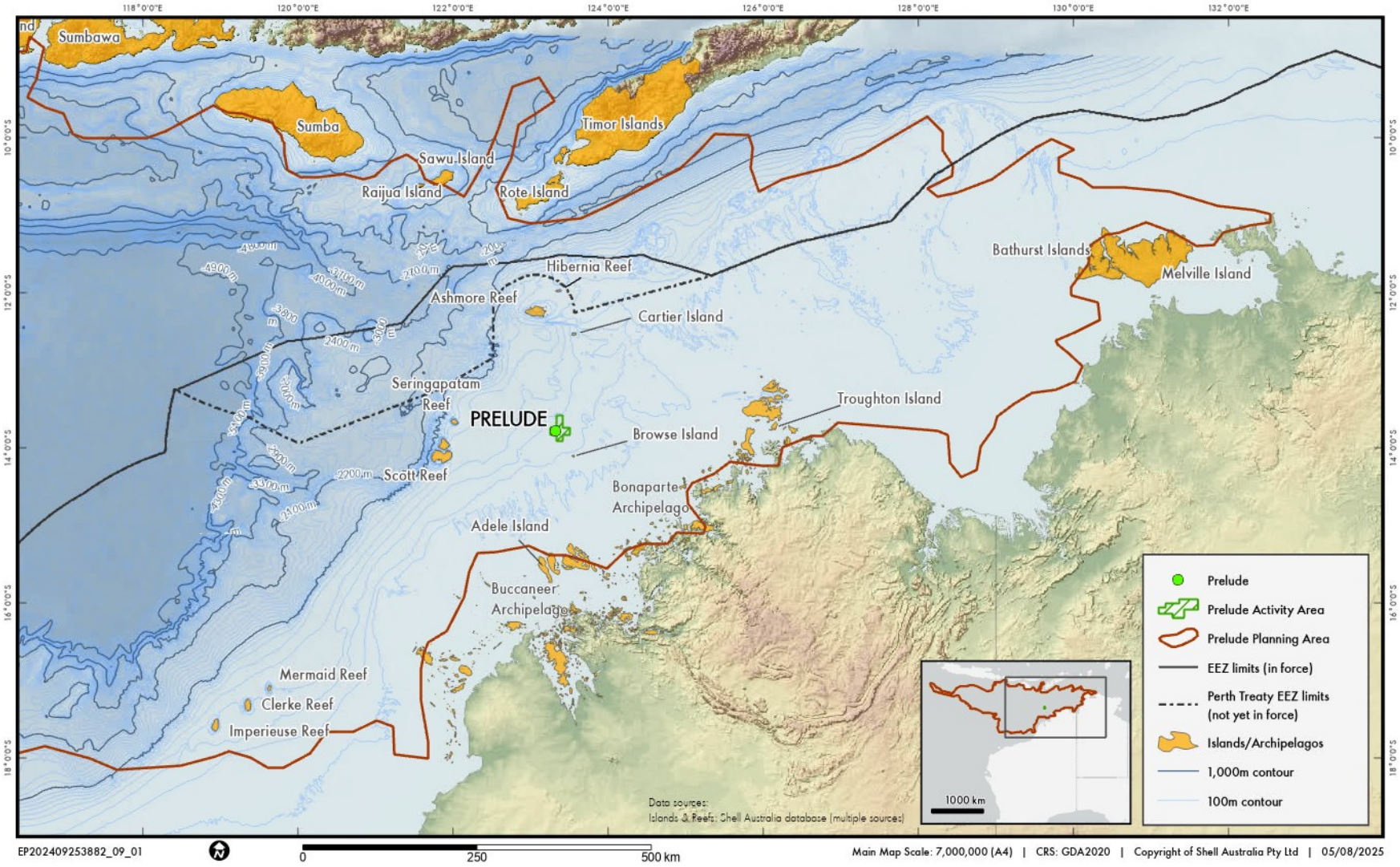


Figure 7-9: Offshore and Coastal Reefs and Islands that are Proximal to or Overlap to the Planning Area

7.7.6 Key Ecological Features

Key Ecological Features (KEFs) are elements of the Commonwealth marine environment that are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity. Although KEFs are not listed as MNES and have no legal status in their own right, they are one of the values and sensitivities of the Commonwealth marine environment, which is protected as MNES. The Activity Area does not intersect any KEFs. The closest KEF is the *Continental slope demersal fish communities* (see Figure 7-10).

Table 7-11 lists the KEFs within the Planning Area and these are illustrated in Figure 7-10. Note: the values described apply to the entire KEF and are not limited to the Planning Area.

Table 7-11: KEFs within the Planning Area, including distance from the Activity Area

KEF	Summary of Key Values	Distance from the Activity Area (~km)	Distance from Prelude (~km)
Ancient coastline at 125 m depth contour	*Unique seafloor feature with ecological properties of regional significance* The areas of hard substrate along this ancient coastline, which follows the 125 m depth contour, are thought to provide biologically important habitats in areas otherwise dominated by soft sediments; thereby providing for higher species diversity and richness relative to the wider region. The topographic complexity of these escarpments may also facilitate vertical mixing of the water column providing a relatively nutrient-rich environment for species present on the escarpment. The KEF encompasses an area of ~16,190 km^2.	36	41
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	*High productivity and aggregations of marine life* Ashmore Reef is the largest of only three emergent oceanic reefs present within the north-eastern Indian Ocean and is the only oceanic reef in the region with vegetated islands. The emergent reefs are known to provide areas of enhanced primary productivity in otherwise oligotrophic environments. Ashmore Reef and Cartier Islands and the surrounding Commonwealth waters are regionally important for feeding and breeding aggregations of seabirds and shorebirds, and other marine life. Ashmore Reef regularly supports more than 40,000 waterbirds (those ecologically dependant on wetlands) and is estimated to support as many as 100,000 seabirds in a 12-month period (Hale 2013). The marine habitats supported by the reefs are nationally and internationally significant, providing habitat for diverse and abundant marine reptile (including feeding, nesting and internesting areas for green, hawksbill and loggerhead turtles) and marine mammal populations, including dugongs. Species at Ashmore and Cartier include more than 225 reef-building corals, 433 molluscs, 286 crustaceans, 192 echinoderms, and 709 species of fish. Thirteen species of sea snakes occur in high numbers at Ashmore and Cartier reefs but are in decline.	109	134

KEF	Summary of Key Values	Distance from the Activity Area (~km)	Distance from Prelude (~km)
	Additionally, Ashmore Reef supports the highest number of coral species of any reef off the WA coast and plays a primary role in the maintenance of the biodiversity of reef systems in the region.		
Canyons linking the Argo Abyssal Plain with the Scott Plateau	*High productivity and aggregations of marine life* Canyons linking the Argo Abyssal Plain with Scott Plateau covers an area of ~836 km^2. The Bowers and Oats canyons are major canyons on the slope between the Argo Abyssal Plain and Scott Plateau and deeply cut into the Scott Plateau at depths of ~2,000 m – 3,000 m. The ocean area above the canyons is thought to be an area of moderately enhanced productivity, attracting aggregations of fish, sharks, toothed whales and dolphins.	370	383
Carbonate bank and terrace system of the Sahul Shelf	*Unique seafloor feature with ecological properties of regional significance* While little is known about this KEF, the carbonate banks and terrace system of the Sahul Shelf is considered regionally important because of their role in enhancing biodiversity and local productivity relative to their surrounds, largely due to the presence of elevated hard substrates. The seabed features are thought to create enhanced productivity and biodiversity as a result of upwellings of cold nutrient-rich water at the heads of the channels. The KEF covers an area of ~41,158 km^2. The banks rise to depths ranging from 150 m to 300 m and are separated from each other by narrow meandering channels which are up to 150 m deep. The hard substrates of the banks are thought to support a high diversity of organisms including reef-fish, sponges, soft and hard corals, gorgonians, bryozoans, ascidians and other sessile filter-feeders.	186	205
Carbonate bank and terrace system of the Van Diemen Rise	*Unique seafloor feature with ecological properties of regional significance* The bank and terrace system of the Van Diemen Rise covers approximately 31,278 km^2 and forms part of the larger system associated with the Sahul Banks to the north and Londonderry Rise to the east. The complex topographic features of the area consist largely of raised geomorphic features (e.g. terraces and banks) with relatively high proportions of hard substrate, supporting sponge and octocoral gardens. These sponge and coral communities in turn provide habitat for epifauna. Infauna, including polychaetes and ascidians, are also scattered throughout the KEF. Variability in water depth and substrate composition is thought to contribute to the richness in benthic epifauna and the unique ecosystems found in the area. The carbonate banks and shoals found within	554	598

KEF	Summary of Key Values	Distance from the Activity Area (~km)	Distance from Prelude (~km)
	the Van Diemen Rise make up 80% of the banks and shoals, 79% of the channels and valleys, and 63% of the terrace found across the NMR. The carbonate banks and shoals rise from depths of 100 m–200 m to within 10 m–40 m of the sea surface (Anderson et al. 2011).		
Continental slope demersal fish communities	*Communities with high species biodiversity and endemism* There is a high diversity of demersal fish assemblages on the Australian continental slope from the North West Cape to the edge of the North Marine Region. Specifically, the continental slope between North West Cape and the Montebello Trough has more than 500 fish species, 76 of which are endemic, which makes it the most diverse slope bioregion in the whole of Australia (DEWHA 2008; DCCEEW 2022). The Timor Province and Northwest Transition bioregions, in which Prelude is located, are the second-richest areas for demersal fish across the entire continental slope. (Brewer et al. 2007) suggested that the demersal-slope communities rely on bacteria and detritus-based systems comprised of infauna and epifauna as the basis of the food web. No relevant pressures of concern have been identified for this KEF for the activities in the scope of this EP (DCCEEW 2022). The KEF covers a vast area of ~33,182 km^2.	1	17
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	*High productivity and aggregations of marine life* The Rowley Shoals consist of three atoll reefs; Clerke, Imperieuse and Mermaid Reef which support 214 coral species and around 530 species of fish. The steep changes in slope around the reef also attract a range of migratory pelagic species such as dolphins, tuna, billfish and sharks. The coral communities of Mermaid Reef are also an important feature. The enhanced productivity at the shoals is thought to be facilitated by the breaking of internal waves in the waters surrounding the reefs, causing mixing and re-suspension of nutrients from water depths of 500–700 m into the photic zone.	512	523
Pinnacles of the Bonaparte Basin	*Unique seafloor feature with ecological properties of regional significance* The limestone pinnacles in the western Bonaparte Depression are expected to support a diverse community in an otherwise oligotrophic system. More than 110 pinnacles occur in the Bonaparte Depression, covering a total area of more than 520 km^2. The pinnacles are thought to be the eroded remnants of underlying strata and can be up to 50 m high and 50 km–100 km long.	440	465

KEF	Summary of Key Values	Distance from the Activity Area (~km)	Distance from Prelude (~km)
Seringapatam Reef and Commonwealth waters in the Scott Reef Complex	*High productivity and aggregations of marine life* The coral communities at Seringapatam and Scott Reefs play a key role in maintaining species richness and aggregations of marine life. The reefs and the waters surrounding them attract aggregations of marine life including humpback whales on their northerly migration, Bryde's whales, pygmy blue whales, Antarctic minke whales, dwarf minke whales, minke whales, dwarf sperm whales, spinner dolphins and whale sharks. Green and hawksbill turtles' nest during the summer months on Sandy Islet on South Scott Reef. These species also internest and forage in the surrounding waters. Scott Reef is a particularly biologically diverse system and includes more than 300 species of reef-building corals, ~400 mollusc species, 118 crustacean species, 117 echinoderm species, around 720 fish species and several species of sea snakes.	124	135
Shelf break and slope of the Arafura Shelf	*Unique seafloor feature with ecological properties of regional significance* The shelf break and slope of the Arafura Shelf is described as a biogeographic crossroad of biota from the Timor-Indonesian-Malay region. Whilst there is limited information about the ecosystem processes of the area, it is thought that the Indonesian Throughflow current and surface wind-driven circulation from the north-west monsoon are a strong influence. These oceanic processes are likely to drive pelagic dispersal of nutrients, species and biological productivity and, in turn, the long-term patterns in transport and dispersal of larvae juvenile and migrating adult organisms through the area. Demersal fish communities are diverse, and the area is likely to support whale sharks, sharks and marine turtles.	776	794

Source: DSEWPaC 2012

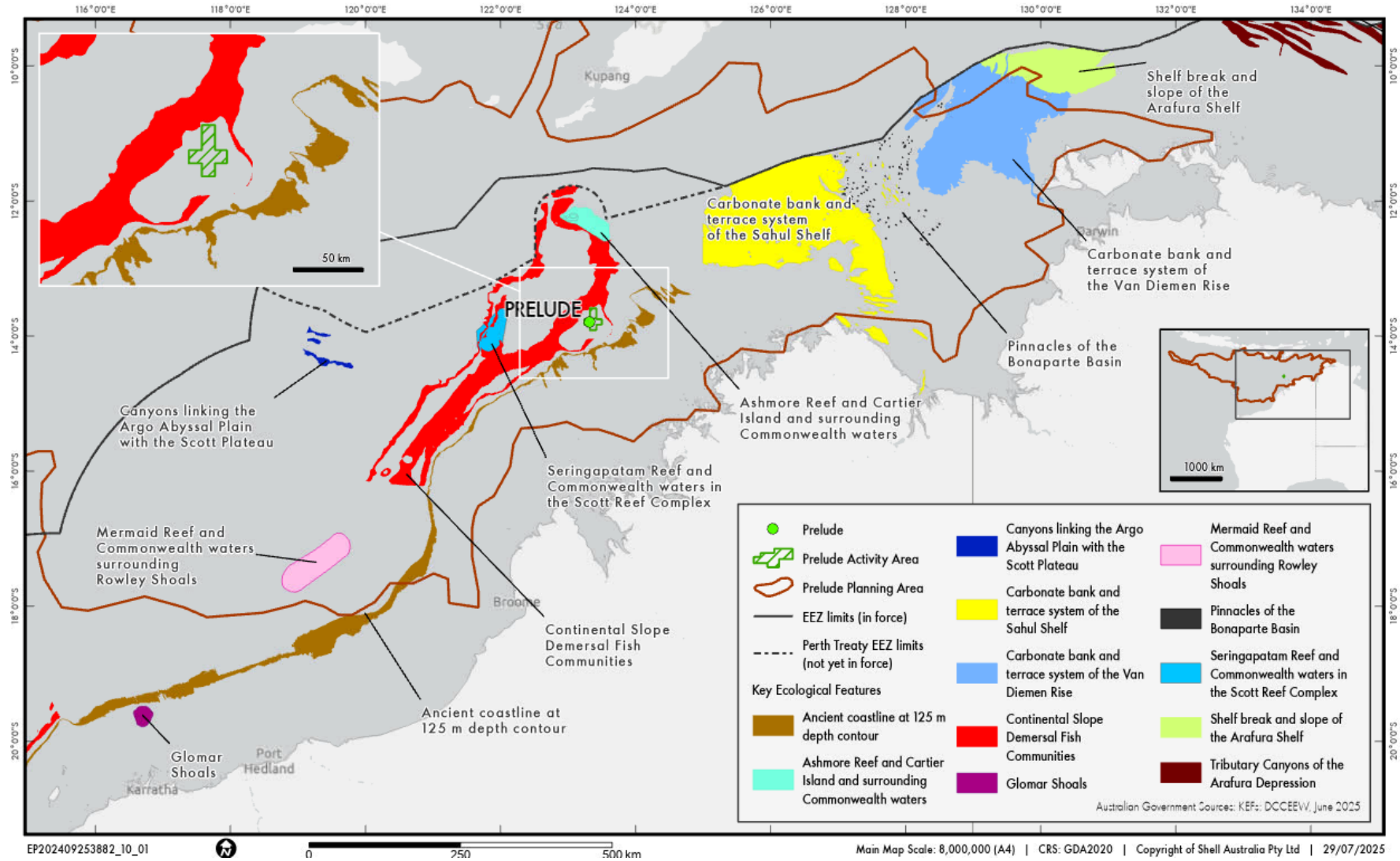


Figure 7-10: Locations of KEFs within the Planning Area

7.7.7 Plankton Communities

Plankton comprises a highly diverse mix of phytoplankton and zooplankton, ranging in size from micrometres to centimetres, that fulfil a diverse range of ecological roles. In addition to ubiquitous taxa such as copepods, euphausiids and chaetognaths, the diversity of zooplankton can be enhanced by the occurrence of pelagic larval stages of a number of invertebrates and fish (ichthyoplankton). In the Planning Area, this includes the commercially important southern bluefin tuna (*Thunnus maccoyii*), with the only known spawning ground for this species in an area encompassing Christmas Island's EEZ and extending towards Java, and north-western Australia (Hobbs et al. 2021), covering over one million km^2 and including much of the NWMR (DCCEEW 2024o).

Plankton distribution is often patchy and linked to localised and seasonal productivity that produces sporadic bursts in phytoplankton, zooplankton and tropical krill production (DEWHA 2008a). Fluctuations in abundance and distribution occur horizontally and vertically in response to tidal cycles, seasonal variation (light, water temperature and chemistry, rainfall, currents and nutrients) and cyclonic events. Generally, in offshore Australian waters, the mixing of deeper, more nutrient-rich waters with warmer surface waters (i.e. areas of upwelling) generates phytoplankton production and zooplankton blooms.

The Planning Area extends over a large area with a wide range of water depths, proximity to terrestrial inputs, geomorphic features and metocean conditions that may all influence plankton communities. The majority of the Planning Area is within oceanic, oligotrophic waters where plankton abundance is generally low. Macrobenthos consist of organisms that live within (infauna) or on (epifauna) the seabed sediments. In the shallower coastal waters of the continental shelf and on reefs and shoals/banks in <50 m water depth, communities of benthic epifauna are abundant and diverse. However, seafloor communities in deeper waters, such as those found within the majority of the Planning Area, including the Activity Area, are generally expected to be less abundant and diverse.

Surveys in the Prelude and Crux development areas show plankton communities to be diverse but low in abundance, with phytoplankton and zooplankton assemblages generally consistent with those recorded in offshore waters of the region (Shell 2009, 2020).

Chlorophyll concentrations (an index of phytoplankton biomass) measured at Crux (160 km northeast of Prelude) were very low (AECOM 2017), below DGV for the North West Shelf bioregion (ANZG 2018). Phytoplankton abundance was also very low at Prelude, with key groups identified by sampling including dinoflagellates (Dinophyceae), diatoms (Bacillariophyceae) and Prasinophyceae. The most abundant species included *Prasinophyte sp.* (Prasinophyceae); *Gyrodinium sp.* and *Heterocapsa sp.* (Dinophyceae); *Pseudonitzschia sp., Cylindrotheca closterium, Chaetoceros sp., Thalassionemafrauenfeldii* and *Nitzschia longissima* (Bacillariophyceae) (Shell 2009).

Zooplankton assemblages were only sampled at the Prelude location and present at low densities, primarily dominated by copepod species (Shell 2009). A few samples were dominated by euphausiids or chaetognaths and a diverse fish larval assemblage was recorded. Although fish larval composition was primarily dominated by neritic species with little or no commercial value, larvae of the commercially targeted Berycidae (alfonsinos), Carangidae (jacks, trevallies), Lutjanidae (snappers), Serranidae (cods), and Scombridae (tunas, mackerels) were also present.

7.7.8 Macrobenthic Communities

Macrobenthos are organisms which live within (infauna) or on (epifauna) the seabed sediments. In the shallower coastal waters of the continental shelf, and on reefs and shoals/banks in less than 50 m water depth, communities of benthic epifauna are abundant and diverse. However, seafloor communities in deeper waters, such as those found within the majority of the Planning Area, are generally expected to be less abundant and diverse. Macrobenthos in the Prelude development area was also recorded as having consistently low abundance and similar composition across the area surveyed (Shell 2009). While individuals were identified from nine different Phyla (Annelida, Chordata, Cnidaria, Crustacea, Echinodermata, Mollusca, Nematoda and Sipuncula), approximately 80% of individuals across the survey area were identified as Annelid worms (Shell 2009). Species from three classes of polychaete worm and mud shrimps (Crustacea) were also dominant.

Seabed habitat surveys in the immediate region include those for the Ichthys Gas Field Development Project, Montara Development Project, Barossa Gas Development, Browse Upstream Development and Bonaparte LNG Project.

The seabed within the Ichthys field (235 m to 275 m), ~164 km south-west of the Crux development area, was characterised by bare substrates supporting an infauna dominated by polychaete worms and crustaceans, and few epibenthic organisms. Areas of hard substrate exhibited a low cover of epibenthic fauna, comprising filter feeding communities including sponges, gorgonians, soft corals (INPEX 2010).

Benthic macrofauna communities in the Barossa development area, ~160 km north-east of the Prelude, were characterised by low abundance and species diversity. The silty sand sediments supported burrowing taxa and the most common phyla within the infaunal communities were Annelida, Mollusca, Foraminifera and Crustacea. Due to the lack of hard substrate, the associated epibenthos was expected to be sparse. Octocorals (particularly sea pens) and motile decapod crustaceans (mostly prawns and squat lobsters) were recorded in relatively low numbers (Jacobs 2016).

The deep-sea seabed (400 m to 600 m) within the Browse development area, ~200 km south-west of Prelude, was observed as comprising fine sand and silt with epibenthic fauna limited to isolated individual bryozoan colonies, brittle stars and basket stars, and sea anemones (Woodside 2014). The most abundant infauna recorded were polychaete bristleworms, accounting for 53.4% of all infaunal assemblages (Woodside 2014).

7.7.9 Threatened Ecological Communities

The EPBC Protected Matters Database does not list any Threatened Ecological Communities (TECs) occurring in the marine environment within the Planning Area.

7.7.10 Threatened, Migratory, Marine and Cetacean Species

Table 7-12 lists the natural values and sensitivity EPBC Act listed threatened and migratory species or species habitat within the Planning Area and subcategories listed in protected matters reports. Appendix C provides a full list of EPBC Act listed marine and cetacean species. Most EPBC Act listed species within the Activity Area are expected to be transitory only.

Note: Several MNES receptors (e.g. terrestrial species) identified by the protected matters reports for the Planning Area will not credibly be impacted by the petroleum activities. These Protected Matters Search Tool (PMST) results are an artefact of the method used to generate the area; this method occasionally overlaps small areas of the terrestrial environment that will not credibly be impacted by the petroleum activity and are excluded from further consideration.

Table 7-12: EPBC Act listed Threatened and Migratory species potentially occurring within the Activity Area and Planning Area

Species Name	Common Name	EPBC Act Listing Status		EPBC Act Management Publications	Presence Type	
		Threatened	Migratory		Activity Area	Planning Area
Mammals						
Balaenoptera borealis	Sei whale	Vulnerable	✓	✓	Species or species habitat likely to occur within area	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni	Bryde's whale	×	✓	✓	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Balaenoptera musculus brevicauda	Pygmy blue whale	Endangered	✓	✓	Species or species habitat likely to occur within area	Migration route known to occur within area
Balaenoptera physalus	Fin whale	Vulnerable	✓	✓	Species or species habitat likely to occur within area	Foraging, feeding or related behaviour likely to occur within area
Megaptera novaeangliae	Humpback whale	×	✓	✓	Species or species habitat known to occur within area	Breeding known to occur within area
Orcinus orca	Killer whale, orca	×	✓	✓	Species or species habitat may occur within area	Species or species habitat may occur within area
Physeter macrocephalus	Sperm whale	×	✓	×	Species or species habitat may occur within area	Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations)	Spotted bottlenose dolphin (Arafura/Timor Sea populations)	×	✓	×	Species or species habitat may occur within area	Species or species habitat known to occur within area
Dugong dugong	Dugong	×	✓	✓	× Anecdotally mentioned that species may transit within the area.	Breeding known to occur within area

Species Name	Common Name	EPBC Act Listing Status		EPBC Act Management Publications	Presence Type	
		Threatened	Migratory		Activity Area	Planning Area
Orcaella heinsohni	Australian snubfin dolphin	Vulnerable	✓	✓	×	Breeding known to occur within area
Sousa sahulensis	Australian humpback dolphin	Vulnerable	✓	✓	×	Breeding known to occur within area
Reptiles						
Caretta caretta	Loggerhead turtle	Endangered	✓	✓	Species or species habitat likely to occur within area	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas	Green turtle	Vulnerable	✓	✓	Species or species habitat likely to occur within area	Breeding known to occur within area
Dermochelys coriacea	Leatherback turtle, leathery turtle, luth turtle	Endangered	✓	✓	Species or species habitat likely to occur within area	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata	Hawksbill turtle	Vulnerable	✓	✓	Species or species habitat likely to occur within area	Breeding known to occur within area
Lepidochelys olivacea	Olive ridley turtle, pacific ridley turtle	Endangered	✓	✓	Species or species habitat likely to occur within area	Breeding known to occur within area
Natator depressus	Flatback turtle	Vulnerable	✓	✓	Species or species habitat likely to occur within area	Breeding known to occur within area
Aipysurus apraefrontalis	Short-nosed sea snake	Critically Endangered	×	✓	×	Species or species habitat known to occur within area
Aipysurus foliosquama	Leaf-scaled sea snake	Critically Endangered	×	✓	×	Species or species habitat may occur within area
Aipysurus fuscus	Dusky sea snake	Endangered	×	✓	×	Species or species habitat known to occur within area

Species Name	Common Name	EPBC Act Listing Status		EPBC Act Management Publications	Presence Type	
		Threatened	Migratory		Activity Area	Planning Area
Crocodylus porosus	Salt-water crocodile, estuarine crocodile	×	✓	×	×	Species or species habitat likely to occur within area
Sharks and Rays						
Anoxypristis cuspidata	Narrow sawfish, knifetooth sawfish	×	✓	×	Species or species habitat may occur within area	Species or species habitat known to occur within area
Carcharhinus longimanus	Oceanic whitetip shark	×	✓	×	Species or species habitat may occur within area	Species or species habitat may occur within area
Carcharias taurus	Grey nurse shark	×	✓	✓	Species or species habitat may occur within area	Species or species habitat may occur within area
Carcharodon carcharias	White shark, great white shark	Vulnerable	✓	✓	Species or species habitat may occur within area	Species or species habitat may occur within area
Glyphis garricki	Northern river shark, New Guinea river shark	Endangered	×	✓	Species or species habitat may occur within area	Species or species habitat may occur within area
Glyphis glyphis	Speartooth Shark	Critically Endangered	×	✓	×	Species or species habitat may occur within area
Isurus oxyrinchus	Shortfin mako, mako shark	×	✓	✓	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Isurus paucus	Longfin mako	×	✓	×	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Manta alfredi	Reef manta ray, coastal manta ray, inshore manta ray, Prince Alfred's ray, resident manta ray	×	✓	×	×	Species or species habitat known to occur within area

Species Name	Common Name	EPBC Act Listing Status		EPBC Act Management Publications	Presence Type	
		Threatened	Migratory		Activity Area	Planning Area
Manta birostris	Giant manta ray, chevron manta ray, Pacific manta ray, pelagic manta ray, oceanic manta ray	×	✓	×	Species or species habitat may occur within area	Species or species habitat known to occur within area
Pristis clavata	Dwarf sawfish, Queensland sawfish	Vulnerable	✓	✓	×	Species or species habitat known to occur within area
Pristis pristis	Freshwater sawfish, largetooth sawfish, river sawfish, Leichhardt's sawfish, northern sawfish	Vulnerable	✓	✓	×	Species or species habitat likely to occur within area
Pristis zijsron	Green sawfish, dindagubba, narrowsnout sawfish	Vulnerable	✓	✓	Species or species habitat known to occur within area	Species or species habitat known to occur within area
Rhincodon typus	Whale shark	Vulnerable	✓	✓	Foraging, feeding or related behaviour known to occur within area	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini	Scalloped hammerhead	Conservation Dependent	×	✓	Species or species habitat may occur within area	Species or species habitat known to occur within area
Birds						
Actitis hypoleucos	Common sandpiper	×	Migratory	✓	Species or species habitat may occur within area	Species or species habitat known to occur within area
Anous stolidus	Common noddy	×	Migratory	✓	Species or species habitat may occur within area	Breeding known to occur within area

Species Name	Common Name	EPBC Act Listing Status		EPBC Act Management Publications	Presence Type	
		Threatened	Migratory		Activity Area	Planning Area
Anous tenuirostris melanops	Australian lesser noddy	Vulnerable	×	✓	Foraging, feeding or related behaviour likely to occur within area	Breeding known to occur within area
Calidris acuminata	Sharp-tailed sandpiper	Vulnerable	Migratory	✓	Species or species habitat may occur within area	Species or species habitat known to occur within area
Calidris canutus	Red knot, knot	Vulnerable	Migratory	✓	Species or species habitat may occur within area	Species or species habitat known to occur within area
Calidris ferruginea	Curlew sandpiper	Critically Endangered	Migratory	✓	Species or species habitat may occur within area	Species or species habitat known to occur within area
Calidris melanotos	Pectoral sandpiper	×	Migratory	✓	Species or species habitat may occur within area	Species or species habitat may occur within area
Calonectris leucomelas	Streaked shearwater	×	Migratory	✓	Species or species habitat known to occur within area	Species or species habitat known to occur within area
Fregata ariel	Lesser frigatebird, least frigatebird	×	Migratory	✓	Species or species habitat likely to occur within area	Breeding known to occur within area
Fregata minor	Great frigatebird, greater frigatebird	×	Migratory	✓	Foraging, feeding or related behaviour likely to occur within area	Breeding known to occur within area
Numenius madagascariensis	Eastern curlew, far eastern curlew	Critically endangered	Migratory	✓	Species or species habitat may occur within area	Species or species habitat known to occur within area
Papasula abbotti	Abbott's booby	Endangered	×	✓	Species or species habitat may occur within area	Species or species habitat may occur within area
Phaethon lepturus	White-tailed tropicbird	×	Migratory	✓	Species or species habitat likely to occur within area	Breeding known to occur within area

Species Name	Common Name	EPBC Act Listing Status		EPBC Act Management Publications	Presence Type	
		Threatened	Migratory		Activity Area	Planning Area
Phaethon lepturus fulvus	Christmas Island white-tailed tropicbird, golden bosunbird	Endangered	×	✓	Species or species habitat may occur within area	Foraging, feeding or related behaviour known to occur within area
Phaethon rubricauda westralis	Red-tailed tropicbird (Indian Ocean)	Endangered	×	✓	Species or species habitat likely to occur within area	Breeding known to occur within area
Acrocephalus orientalis	Oriental Reed-Warbler	×	Migratory	×	×	Species or species habitat known to occur within area
Apus pacificus	Fork-tailed swift	×	Migratory	×	×	Species or species habitat likely to occur within area
Ardenna pacifica	Wedge-tailed shearwater	×	Migratory	✓	×	Breeding known to occur within area
Arenaria interpres	Ruddy turnstone	Vulnerable	Migratory	✓	×	Species or species habitat likely to occur within area
Calidris alba	Sanderling	×	Migratory	✓	×	Species or species habitat likely to occur within area
Calidris tenuirostris	Great knot	Vulnerable	Migratory	✓	×	Species or species habitat likely to occur within area
Cecropis daurica	Red-rumped Swallow	×	Migratory	✓	×	Species or species habitat may occur within area
Charadrius leschenaultii	Greater sand plover, large sand plover	Vulnerable	Migratory	✓	×	Species or species habitat known to occur within area
Charadrius mongolus	Lesser sand plover, Mongolian plover	Endangered	Migratory	✓	×	Species or species habitat likely to occur within area
Charadrius veredus	Oriental plover, oriental dotterel	×	Migratory	✓	×	Species or species habitat may occur within area

Species Name	Common Name	EPBC Act Listing Status		EPBC Act Management Publications	Presence Type	
		Threatened	Migratory		Activity Area	Planning Area
Cuculus optatus	Oriental Cuckoo, Horsfield's Cuckoo	×	Migratory	×	×	Species or species habitat known to occur within area
Fregata andrewsi	Christmas Island frigatebird, Andrew's frigatebird	Endangered	Migratory	✓	×	Foraging, feeding or related behaviour likely to occur within area
Glareola maldivarum	Oriental pratincole	×	Migratory	✓	×	Species or species habitat may occur within area
Hirundo rustica	Barn Swallow	×	Migratory	×	×	Species or species habitat known to occur within area
Hydroprogne caspia	Caspian tern	×	Migratory	✓	×	Breeding known to occur within area
Limnodromus semipalmatus	Asian dowitcher	Vulnerable	Migratory	✓	×	Species or species habitat known to occur within area
Limosa lapponica	Bar-tailed godwit	×	Migratory	✓	×	Species or species habitat known to occur within area
Limosa lapponica baueri	Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit	Endangered	×	✓	×	Species or species habitat may occur within area
Limosa lapponica menzbieri	Northern Siberian bar-tailed godwit, bar-tailed godwit (menzbieri)	Endangered	×	✓	×	Species or species habitat known to occur within area
Limosa limosa	Black-tailed godwit	Endangered	Migratory	✓	×	Species or species habitat likely to occur within area

Species Name	Common Name	EPBC Act Listing Status		EPBC Act Management Publications	Presence Type	
		Threatened	Migratory		Activity Area	Planning Area
Motacilla cinerea	Grey Wagtail	×	Migratory	×	×	Species or species habitat known to occur within area
Motacilla flava	Yellow Wagtail	×	Migratory	×	×	Species or species habitat known to occur within area
Numenius phaeopus	Whimbrel	×	Migratory	✓	×	Species or species habitat likely to occur within area
Onychoprion anaethetus	Bridled tern	×	Migratory	✓	×	Breeding known to occur within area
Pandion haliaetus	Osprey	×	Migratory	✓	×	Breeding known to occur within area
Phaethon rubricauda	Red-tailed tropicbird	×	Migratory	✓	×	Breeding known to occur within area
Pluvialis squatarola	Grey plover	Vulnerable	Migratory	✓	×	Species or species habitat likely to occur within area
Rostratula australis	Australian painted-snipe, Australian painted snipe	Endangered	×	✓	×	Species or species habitat likely to occur within area
Sterna dougallii	Roseate tern	×	Migratory	✓	×	Breeding known to occur within area
Sternula albifrons	Little tern	Vulnerable	Migratory	✓	×	Breeding known to occur within area
Sula dactylatra	Masked booby	×	Migratory	✓	×	Breeding known to occur within area
Sula leucogaster	Brown booby	×	Migratory	✓	×	Breeding known to occur within area

Species Name	Common Name	EPBC Act Listing Status		EPBC Act Management Publications	Presence Type	
		Threatened	Migratory		Activity Area	Planning Area
Sula sula	Red-footed booby	×	Migratory	✓	×	Breeding known to occur within area
Thalasseus bergii	Greater crested tern	×	Migratory	✓	×	Breeding known to occur within area
Tringa nebularia	Common greenshank, greenshank	Endangered	Migratory	✓	×	Species or species habitat likely to occur within area

CP (Shorebirds) = CoA 2015c
CP (Seabirds) = CoA 2020

7.7.10.1 Marine Mammals

Marine mammals are typically widely distributed and highly mobile animals. In general, distribution patterns reflect seasonal feeding areas, characterised by high productivity, and migration routes associated with reproductive patterns.

Table 7-12 lists the EPBC Act listed threatened and migratory marine mammals that may occur within the Activity and Planning Areas.

The marine mammal BIAs that may occur within the Planning Area are listed in Table 7-13 and shown in Figure 7-11 to Figure 7-17. Sections 0 to 7.7.10.1.3 describe the marine mammal values and sensitivities of the EPBC Act listed threatened and migratory species.

Table 7-13: BIAs of Marine Mammals within the Planning Area

BIA Behaviour	General Location(s)	Distance from Activity Area (~km)	Distance from Prelude (~km)
Pygmy Blue Whale			
Foraging	Perth Canyon and adjacent waters, less defined and lower density along Ningaloo reef and around Scott Reef.	124	132
Migration	Deep offshore waters (500 m to 1,000 m) along the continental shelf edge off the WA coastline, extending offshore near Scott Reef and into Indonesian waters. Appear close to coast in the Exmouth-Montebello Islands area on southern migration.	78	85
Humpback Whale			
Calving	Offshore from Derby and Horizontal Falls.	130	145
Migration (north and south)	The northern end of BIA offshore to Broome.	328	316
Migration	Offshore from Derby and Horizontal Falls.	130	145
Nursing	Offshore from Derby and Horizontal Falls.	130	145
Resting	Offshore from Derby and Horizontal Falls.	130	145
Dugong			
Breeding	Ashmore Reef (far west)	156	176
Calving	Ashmore Reef (far west)	156	176
Foraging	Ashmore Reef (far west)	156	176
Foraging (high density seagrass beds)	Ashmore Reef (south on the sea reef side only not including the interior)	147	168
Nursing	Ashmore Reef (far west)	156	176
Australian snubfin dolphin			
Breeding	Along northern coastline of WA. Limited data is available for the Australian Snubfin Dolphin, resulting in reproductive parameters being estimated from the closely related Irrawaddy Dolphin. The Irrawaddy Dolphin's mating season is from March to June.	173	190
Resting	Along northern coastline of WA.	173	190

BIA Behaviour	General Location(s)	Distance from Activity Area (~km)	Distance from Prelude (~km)
Calving		173	190
Foraging (high density prey)		173	190
Foraging		168	187
Australian Humpback Dolphin			
Breeding	Within St George Basin, King Sound and Collier Bay, Doubtful Bay and George Water in the Kimberley	173	190
Calving	Within St George Basin and around Bigge Island, Doubtful Bay and George Water in the Kimberley.	173	190
Foraging	Around Cape Bougainville in the Kimberley, Bigge Island Admiralty Gulf and Cape Bougainville.	173	190
Foraging (high density prey)	Within Yorke Sound, Prince Frederick Harbour and St George Basin and around Cape Bougainville in the Kimberley.	168	187
Indo-Pacific/ spotted bottlenose dolphin			
Calving	Around Augustus Island and within King Sound	173	190
Foraging		173	190

7.7.10.1.1 Whales

Sei Whale

Sei whales (*Balaenoptera borealis;* vulnerable, migratory) have a global distribution. Though sightings are uncommon, the species may be seen in coastal and offshore waters throughout Australia, as well as the waters surrounding Christmas and Cocos Keeling Islands (Bannister et al. 1996, DoEE 2019). The species utilises a range of marine habitats, which has been attributed to a combination of dynamic physical and prey processes (DoEE 2019).

Sei whale migratory movements are well defined (distinctly north-south) with the species moving between polar, temperate and tropical waters for foraging and breeding. The species feeds intensively between the Antarctic and sub-Antarctic boundary on planktonic crustaceans (Bannister et al. 1996, DoEE 2019). The species does not dive, rather it sinks, and tends to swim at shallower depths comparative to other species (DoEE 2019).

Bryde's Whale

Bryde's whales (*Balaenoptera edeni*; migratory) distribution encompasses tropical and warm temperate waters with individuals being recorded in all Australian states (Ceccarelli et al. 2011; McPherson et al. 2016). The species typically moves between 40 °N and 40 °S, with these movements seeming to be primarily linked to prey availability (DoE 2023h). Bryde's whales are thought to be divided into offshore and onshore forms with the distinction between the two based on prey preference (DoE 2023h; Ceccarelli et al. 2011). The offshore form is found in deeper waters (500 m to 1,000 m) and is thought to migrate seasonally in favour of warmer waters in winter months. The inshore form generally inhabits waters over 200 m and displays no distinct migratory movements (DoE 2023h).

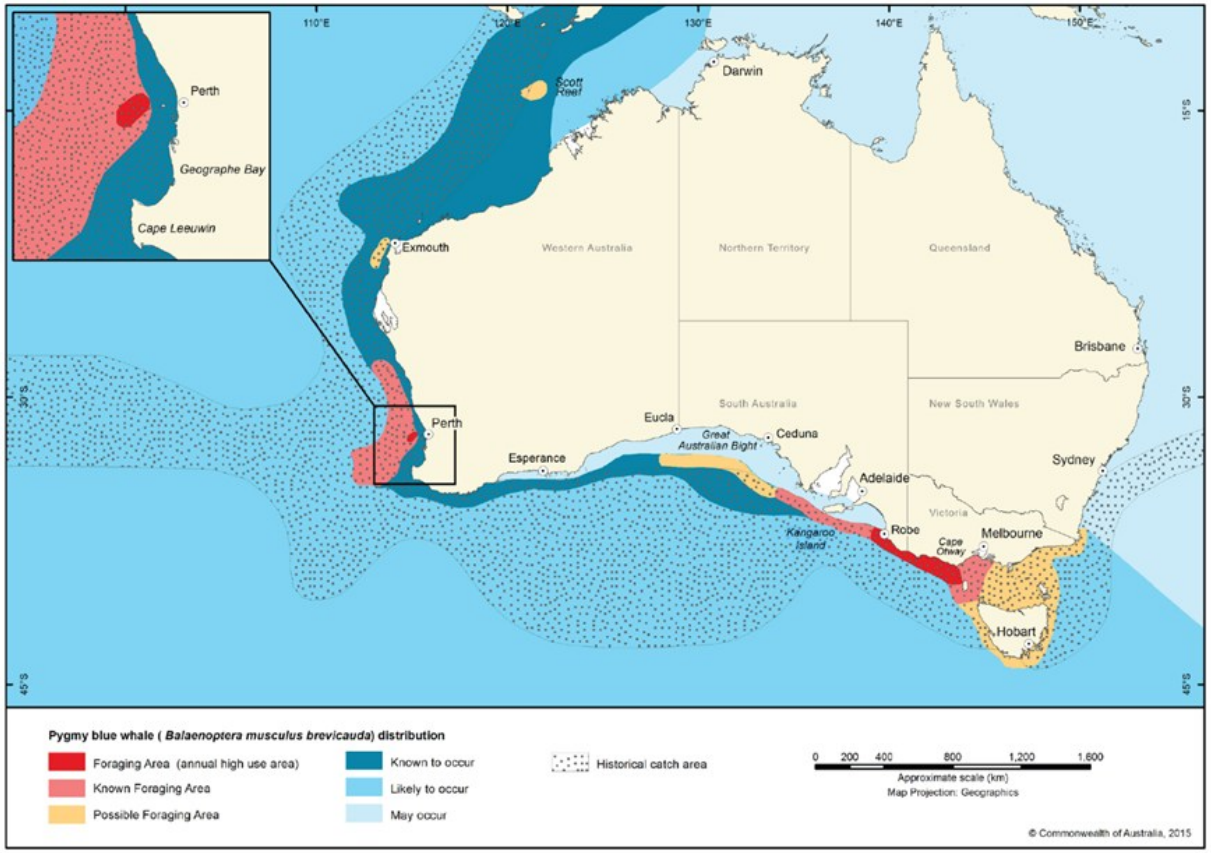
Blue Whale

The blue whale (*Balaenoptera musculus*; endangered, migratory) has four distinct sub-species, of which two are found in the southern hemisphere; the pygmy blue whale (*B. m. brevicauda*; Indo-Australian and Tasman-Pacific populations) and the Antarctic blue whale (*B. m. intermedia*; CoA 2015a).

The pygmy blue whale is known to migrate along the WA coastline between the 500 m and 1,000 m depth contours from Geographe Bay to the NW Cape and in the deep offshore waters off northern WA (Figure 7-10; CoA 2015a). The pygmy blue whale tagging studies by Thums et al. (2022) and Ferreira et al. (2024) found that pygmy blue whales demonstrate extensive use of slope habitat off the WA coastline and limited use of WA shelf waters. These studies indicate that pygmy blue whales are predominantly present in water depths >250 m. The Planning Area overlaps part of this recognised biologically important migration corridor (Figure 7-12; IUCN-MMPATF 2023a; DCCEEW 2023d). The northerly migration toward the calving grounds near the equator occurs in March/April to June (Thums et al. 2021; CoA 2015a). Noise monitoring for the Barossa Gas Project, which is located in the Timor Sea ~873 km north-east of Prelude, detected the presence of blue whales in the months of May to August during their north-bound seasonal migration (McPherson et al. 2016). The southerly migration to the feeding grounds in the high latitudes of the southern hemisphere occurs in September/October to December (CoA 2015a). Pygmy blue whales appear to travel as individuals or in small groups when making their migrations, based on acoustic data from noise loggers deployed around Scott Reef for the Woodside Browse Project (Woodside 2014). During their migratory period along the coast of WA, the pygmy blue whales travel predominantly fast, with directed travel interspersed with relatively short periods of low move persistence in three main areas—Perth Canyon, Cape Range Canyon and Cloates Canyon. The low move persistence could indicate foraging, resting or breeding behaviours (Thums et al. 2022), supporting the ‘possible’ foraging areas identified in the Blue Whale Recovery Plan (CoA 2015a).

A known biologically important foraging area has been mapped at Seringapatam Reef, Scott Reef and the open waters to the west of these features, as shown in Figure 7-12. Canyons and/or steep gradient reef-features at these locations tend to stimulate upwelling and, in turn, seasonally variable increased productivity which may provide a favourable foraging area (ConocoPhillips 2018). Recent research suggested that the locations and/or relative importance of foraging areas may be dynamic and varying according to prey abundance (Thum et al. 2022).

No pygmy blue whale BIAs overlap the Activity Area; two BIAs (foraging and migration corridor) were identified within the Planning Area (Table 7-13 and Figure 7-12).



Foraging Area (Annual high use area)	Blue whales are regularly observed feeding on a seasonal basis
Known Foraging Area	Known foraging occurs in these areas but is highly variable both between and within seasons
Possible Foraging Area	Evidence for feeding is based on limited direct observations or through indirect evidence, such as occurrence of krill in close proximity of whales, or satellite tagged whales showing circling tracks. Blue whales travel through on a seasonal basis, possibly as part of their migratory route

Known to occur	Blue whales are known to occur based on direct observations, satellite tagged whales or based on acoustic detections
Likely to occur	Blue whales are likely to occur based on occasional observations in the area and nearby areas
May occur	Evidence for the presence of blue whales through strandings or rare observations
Historical catch area	Blue whales were caught during the whaling period based on whaling data

Figure 7-11: Pygmy Blue whale Distribution around Australia (CoA 2015a)

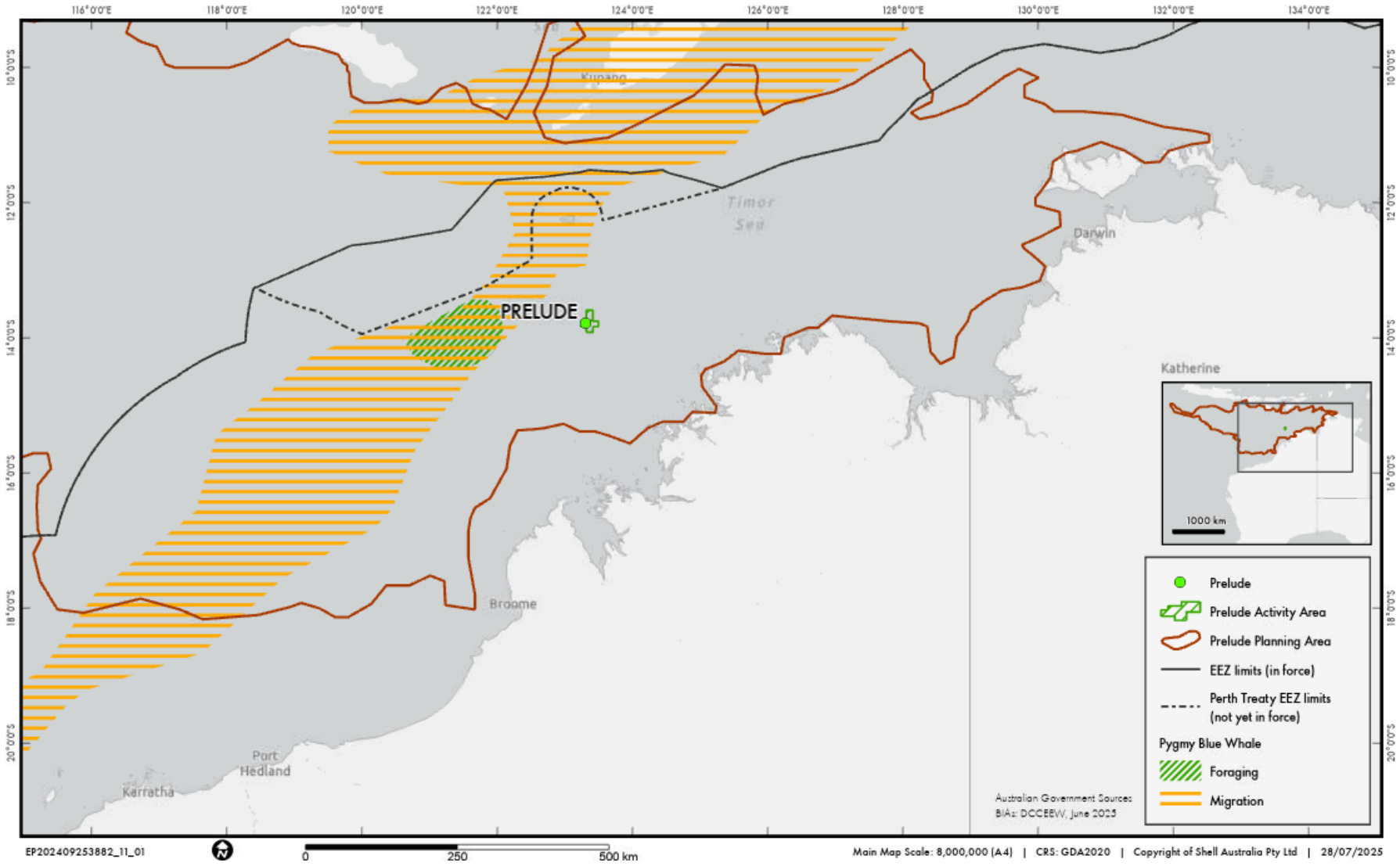


Figure 7-12: BIAs for blue and pygmy blue whales within the Planning Area

Fin Whale

Fin whales (*Balaenoptera physalus*; vulnerable, migratory) are widely distributed from polar to tropical waters and have been recorded in all Australian states, other than New South Wales (NSW) and the NT (Bannister et al. 1996). Fin whales feed on planktonic crustacea, such as Antarctic krill, and primarily forage in high latitudes.

The species rarely occupies inshore waters and displays well defined migratory movements (essentially north-south) between polar, temperate and tropical waters and may migrate through the region (DoE 2023e; Ceccarelli et al. 2011; Bannister et al. 1996). Recent research by Aulich et al. (2019) found that predominately fin whales travel up the WA coast as far north as Dampier (19°S) (outside of the Planning Area).

Humpback Whales

The humpback whale (*Megaptera novaeangliae*; migratory) has a wide distribution, with recordings throughout Australian Antarctic waters and offshore from all Australian states (Bannister et al. 1996).

Humpback whales migrate between summer feeding grounds in Antarctica and winter breeding and calving grounds in the sub-tropical and tropical inshore waters of north-west Australia (Jenner et al. 2001). Although the exact timing of migration varies annually due to a number of factors such as water temperature (DoE 2023c), the northbound migration peaks between late July and early August, and the southbound migration peaks between late August and early September (Jenner et al. 2001). Relatively few humpback whales have been known to travel north of Camden Sound, (Jenner et al. 2001) and noise monitoring undertaken for the Barossa Gas Project located within the North Marine Region (NMR) did not detect any humpback whale calls in the Timor Sea (McPherson et al. 2016).

Studies have generally indicated a steady recovery in the size of the humpback population that migrates along the WA coastline since the cessation of commercial whaling, and the species was removed from the EPBC Act threatened species list in 2022 (DAWE 2022).

No identified BIAs overlap the Activity Area but BIAs for calving, migration, nursing and resting have been identified that overlap the wider Planning Area (Figure 7-13).

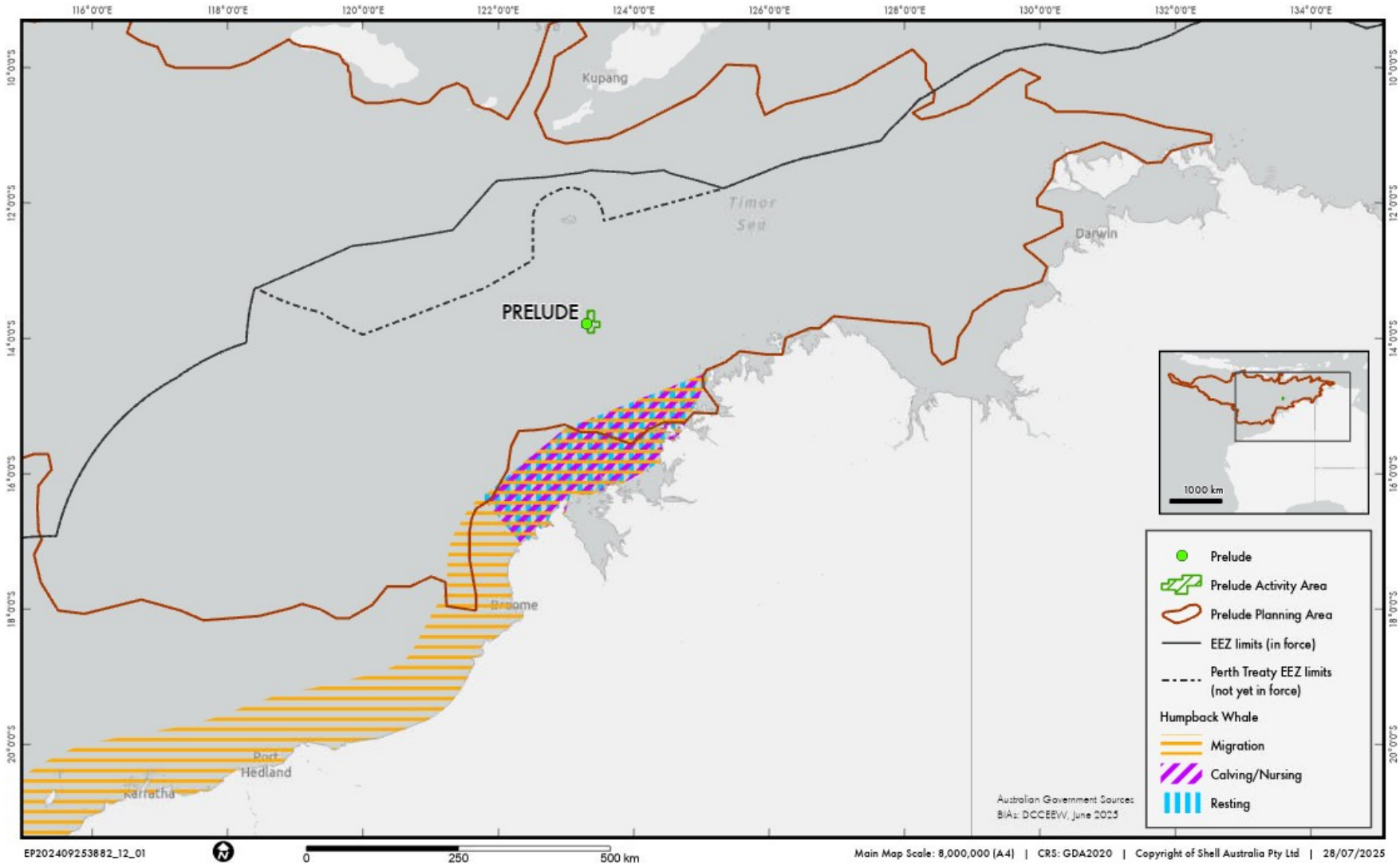


Figure 7-13: BIAs for humpback whales within the Planning Area

Killer Whale

Killer whales (*Orcinus orca,* migratory) are a cosmopolitan species with a vast global distribution across a wide range of habitats. However, they appear to be primarily concentrated in temperate coastal waters and cooler regions of high productivity as they are carnivores with a diet which varies seasonally and regionally (DoE 2023v; Bannister et al. 1996).

Two distinct populations have been identified off the WA coast; one inhabits shallow, nearshore waters, off the Ningaloo Coast, and a second larger population occurs in temperate waters off the WA south coast (both outside the Planning Area) (Reeves et al. 2022; Totterdell et al. 2022).

Based on their known distribution and movements, killer whales may be encountered within the Activity Area and Planning Area in low numbers.

Sperm Whale

Sperm whales (*Physeter macrocephalus*; migratory) occur in deep waters in all oceans, typically remaining at depths of 300 m or greater, and are known to occur throughout Australian waters (Ceccarelli et al. 2011; Bannister et al. 1996). Migration patterns vary between sexes. Mature females and juveniles are thought to be resident in tropical and subtropical waters throughout the year, whereas mature males are thought to migrate between the tropics and Antarctic (DoE 2023i; Bannister et al. 1996; Ceccarelli et al. 2011). Sperm whales have a diverse diet, although they primarily feed on oceanic squid (Bannister et al. 1996; DoE 2023i).

Key areas for sperm whales are known to occur in WA waters between Cape Leeuwin and Esperance and along the continental shelf ~20 nm to 30 nm offshore (outside of the Planning Area) (Bannister et al. 1996).

Considering the known distribution of the species, sperm whales may transit through the Activity Area and Planning Area in low numbers.

7.7.10.1.2 Dolphins

Australian Snubfin Dolphin

The Australian snubfin dolphin (*Orcaella heinsohni*, migratory, also known as the Irrawaddy dolphin, *O. brevirostris*) is a poorly known species inhabiting shallow coastal and estuarine waters and tidal rivers typically in waters <20 m deep in the vicinity of freshwater outflows. However, this species has also been recorded up to 23 km offshore (DoE 2023g; Bouchet et al. 2021). The Australian snubfin dolphin is likely to occur in higher densities in areas of complex habitat type which provide a variety of prey types (Palmer et al. 2014; DSEWPaC 2012b).

In Australia, this species occurs in coastal waters of Queensland, Northern Territory and north-western Australia. The population in Australian waters is thought to be continuous with the Papua New Guinea species but separate from populations in Asia. Within the NWMR the species is likely to migrate and forage off the eastern and western sides of the Cambridge Gulf; to the north and north-west of Cape Londonderry and Cape Talbot; west of Augustus Island; west and north-west of the Buccaneer Archipelago; and Cape Leveque to Broome (DSEWPaC 2012c). Breeding is thought to occur throughout the year for this species.

This species is not expected to occur within the Activity Area due to its preference for coastal habitats but may be present in coastal areas of the Planning Area. No BIAs occur within the Activity Area. Several BIAs occur within the Planning Area (primarily within the Lalang-garram/Camden Sound Marine Park), including foraging, breeding, resting and calving (190 km south of Prelude) (Figure 7-14).

Australian Humpback Dolphin

The Australian humpback dolphin (*Sousa sahulensis*; migratory, previously/also known as the Indo-pacific humpback dolphin, *Sousa chinensis*) occur from northern Australia to Papua New Guinea (Jefferson & Rosenbaum 2014 in DoE 2023f; Beasley et al. 2016).

Although distribution, life history and habitat preferences of the Australian humpback dolphin are poorly understood (DoE 2023f; Hanf et al. 2016; Palmer et al. 2014). In Australia, humpback dolphins occur along the northern Australian coastline from Shark Bay, WA to southern Queensland (Qld) (DoE 2023f; Raudino et al. 2018; Hanf et al. 2016). In the NWMR, this species is thought to inhabit coastal waters up to the 30 m

isobath (Hanf et al. 2016), but Australian humpback dolphins have been recorded up to 80 km offshore (Raudino et al. 2018).

Given the species' preferred habitat is relatively shallow coastal waters, Australian humpback dolphins are very unlikely to occur in the Activity Area but may be present in coastal areas of the Planning Area. There are several BIAs within the Planning Area (Figure 7-15) along the Kimberley coast, including foraging, breeding, calving and resting, the closest of which is approximately 190 km from the Prelude FLNG facility.

Spotted Bottlenose Dolphin

The spotted bottlenose dolphin (Arafura/Timor Sea populations) (*Tursiops aduncus;* migratory) occurs primarily in continental shelf waters (<200 m deep), nearshore and in areas with rocky or coral reefs, sandy or soft sediments, or seagrass beds (DSEWPaC 2012c). Small populations also occur in the inshore waters of some oceanic islands (Ceccarelli et al. 2011).

In Australia, migration patterns for the species are variable, including year-round residency in small areas, long-range movements and migration (DoE 2023f). In the NWMR, Roebuck Bay, Maret Islands and Yampi Sound are important habitats for feeding, breeding and calving, with groups resident at Browse Island, Rowley Shoals and other island and reef complexes in offshore waters (Ceccarelli et al. 2011). Spotted bottlenose dolphins are also known to across the Pilbara coast (Onslow, Dampier and Port Hedland) to Cable Beach and Roebuck Bay (Broome) in the western Kimberley (Allen et al. 2012).

There are BIAs within the Planning Area for calving and foraging (Table 7-13 and Figure 7-16) of which is approximately 190 km from the Prelude FLNG facility. Due to their tendency to shallow water areas, it is unlikely that the species will occur in the Activity Area but is likely to occur in coastal waters in the Planning Area.

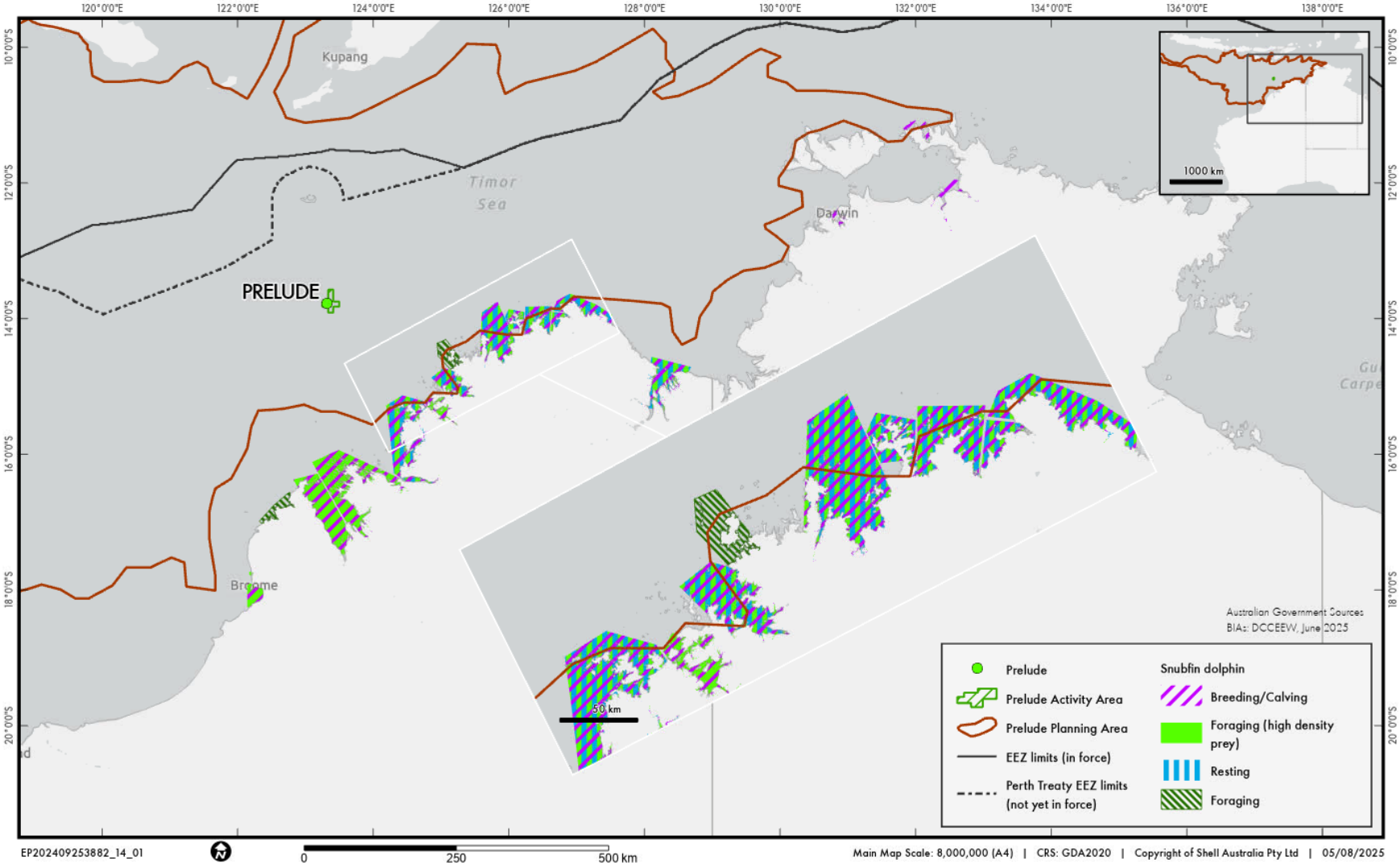


Figure 7-14: BIAs for Australian Snubfin dolphin within the Planning area

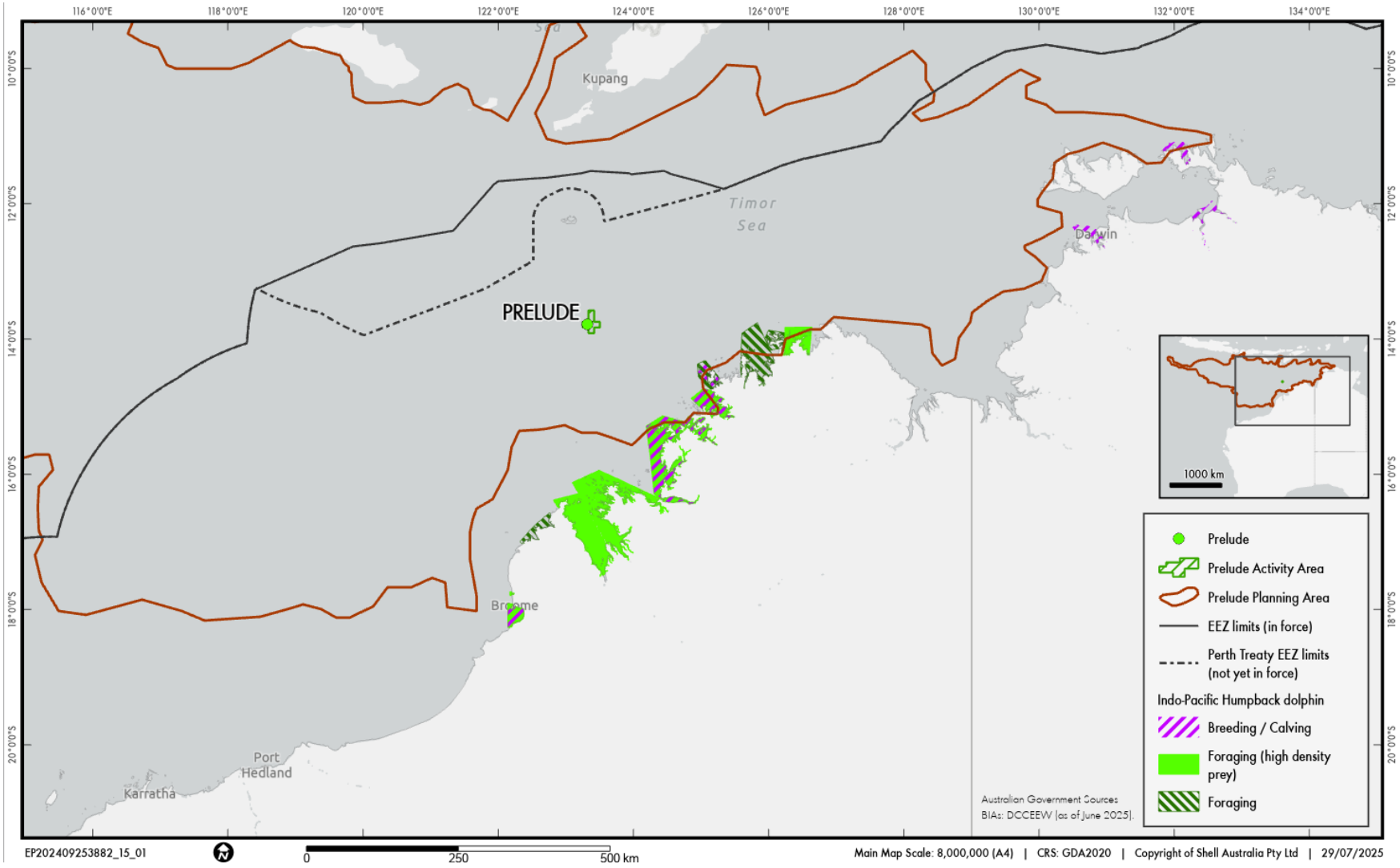


Figure 7-15: BIAs for Indo-Pacific humpback dolphin

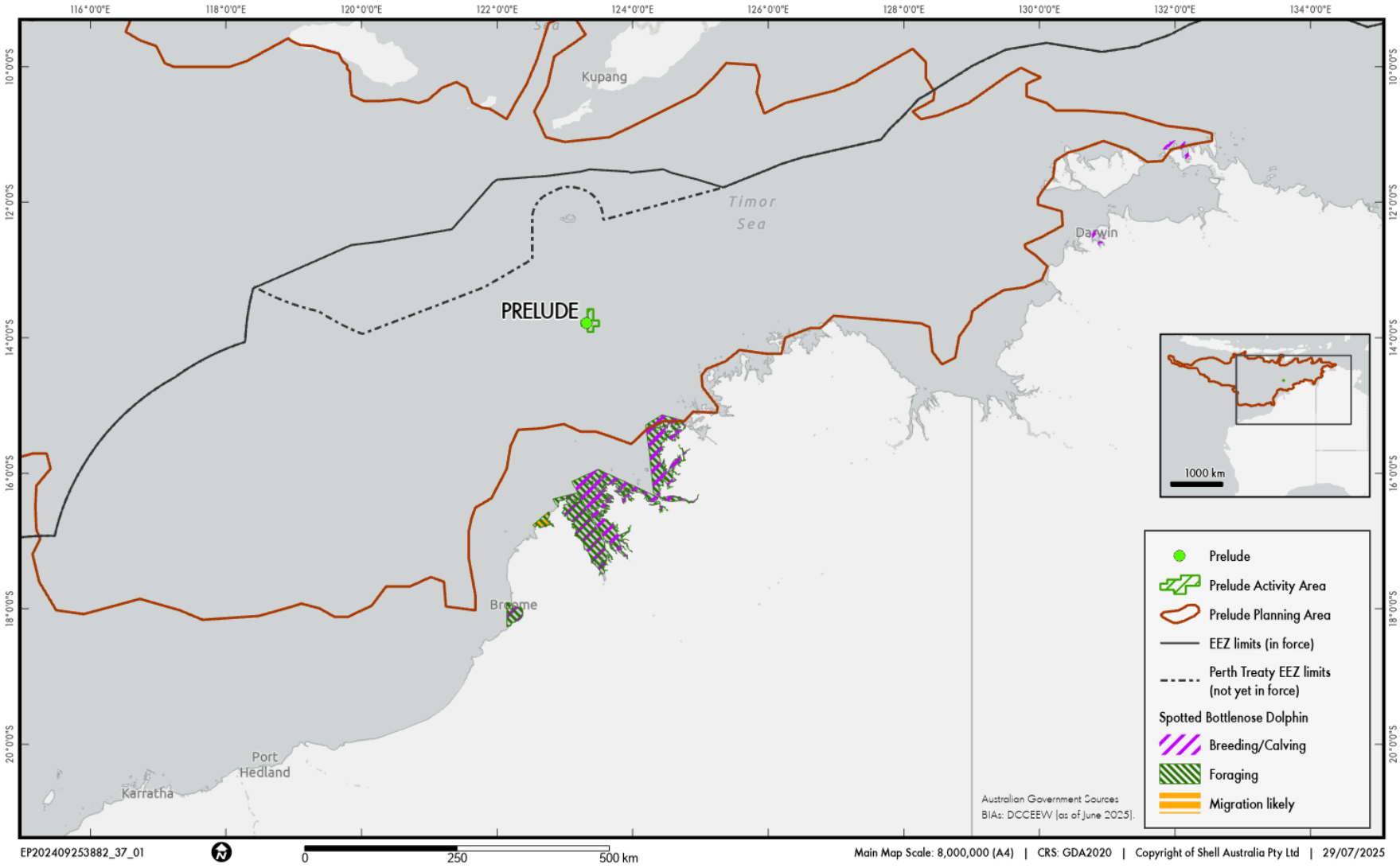


Figure 7-16: BIAs for Spotted Bottlenose Dolphin

7.7.10.1.3 Dugong

Dugongs (*Dugong dugon*; migratory) occur in tropical and sub-tropical coastal and island waters broadly coincident with the distribution of seagrasses, which typically occur in shallow intertidal areas to water depths of around 25 m (DoE 2023t). Dugong feeding aggregations tend to occur in large seagrass meadows within wide shallow protected bays, shallow mangrove channels and in the lee of large inshore islands. Although the movements of most individuals are limited to within tens of kilometres of the vicinity of seagrass beds (National Oceans Office 2004), some individuals travel up to 1,000 km (Hobbs and Willshaw 2016; Whiting 2008).

Dugongs and areas of potential dugong habitat exist along the majority of the WA north from Shark Bay and NT coastline (including islands). Within the Planning Area there are several known BIAs located at Ashmore Reef (see Figure 7-17 and Table 7-13) approximately 168 km north of the Prelude FLNG facility. A small population of ~50 individuals occur at Ashmore Reef, which is considered to be genetically distinct from other nearby Australian or Indonesian populations (DoE 2014a). It is possible that the range of this population extends to Cartier Island where individuals have been recorded (DoE 2014a). Dugongs may also frequent other shallow shoals on the Sahul Banks; however, there has only been a single sighting of this occurrence in 1996 (Whiting and Guinea 2003).

There have also been anecdotal sightings within or in close proximity to the Activity Area (per comms Craig McPherson, JASCO 2023).

Considering the habitat preference of the species, dugongs may occur within the Activity Area but are more likely expected to occur in coastal waters and around islands in the Planning Area.

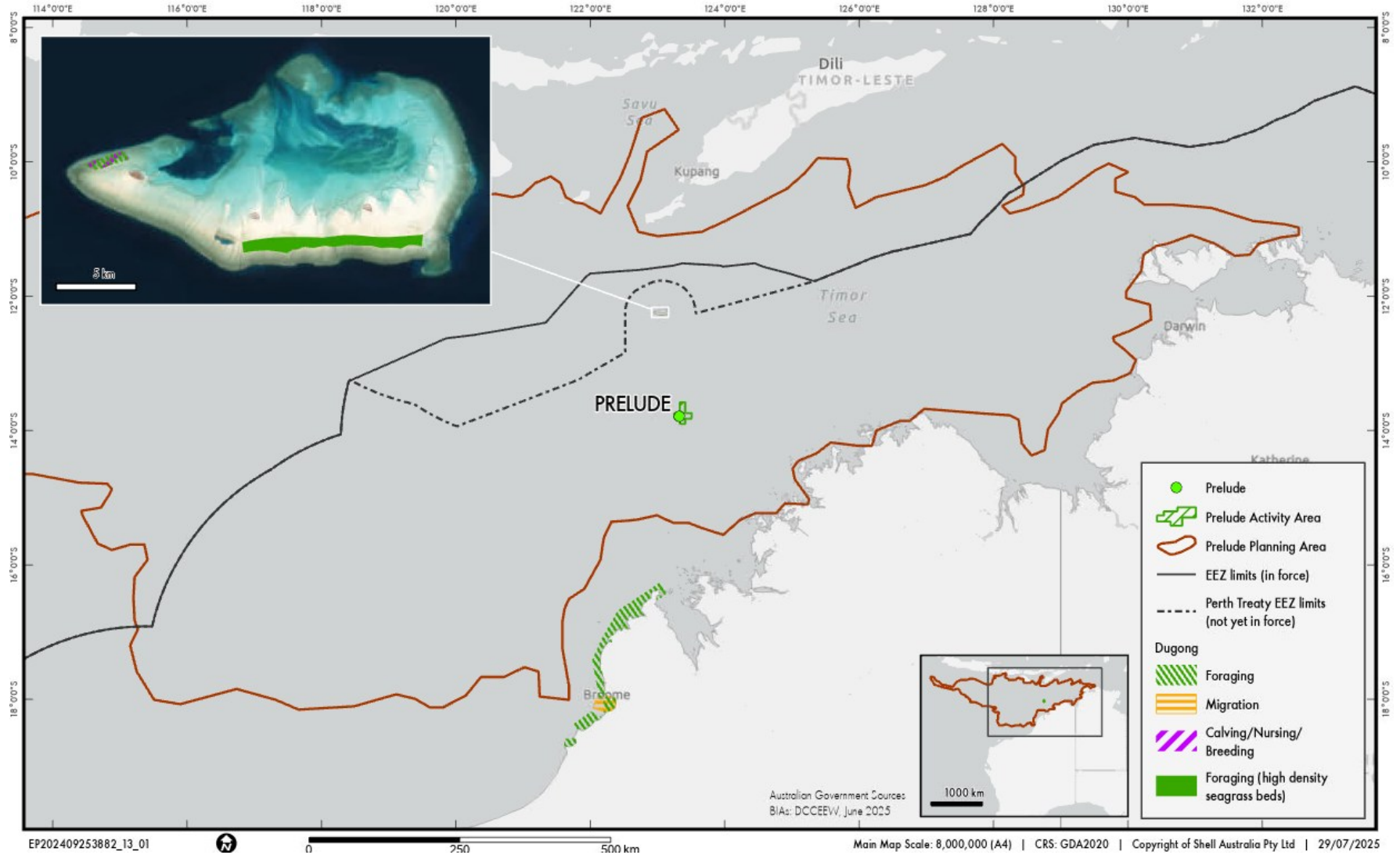


Figure 7-17: BIAs for Dugong within the Planning area

7.7.10.2 Reptiles

7.7.10.2.1 Marine Turtles

Turtles are oceanic species coming ashore only during seasonal nesting periods, which are species-dependent and vary along the north Australian coastline. While the incubation time between turtle nesting and hatchling emergence varies between species, it is generally about two months (CoA 2017b). Female turtles also exhibit an internesting phase in which they spend two–three months in shallow waters in the vicinity of the nesting beach or rookery while they produce the next clutch of eggs (Guinea 2013; CoA 2017b). The female turtles will rest on the seabed during the internesting period but are not known to feed (ConocoPhillips 2018).

The marine turtle BIAs within the Planning Area and the distances to the Activity Area are listed in Table 7-14 and illustrated in Figure 7-18 to Figure 7-23. Table 7-15 lists and Figure 7-24 shows the habitat critical to the survival to marine turtles based on geographically distinct genetic stocks that may occur within the Planning Area.

Table 7-14: BIAs of Marine Turtles that Overlap the Planning Area

Common Name	BIA Behaviour	Distance from Activity Area (~km)	Distance from Prelude (~km)
Flatback turtle	Foraging	323	344
	Internesting Buffer	256	269
	Internesting	346	360
Green turtle	Foraging	25	43
	Internesting	152	174
	Internesting buffer	96	121
	Mating	152	174
	Nesting	117	139
Hawksbill turtle	Foraging	116	141
	Internesting buffer	142	150
	Nesting	149	171
Loggerhead turtle	Foraging	330	350
Leatherback	Internesting	989	995
Olive ridley turtle	Foraging	325	344
	Internesting	755	769

Table 7-15: Habitat Critical to the Survival of Marine Turtles within the Planning Area

Common Name	Genetic Stock	Nesting Location	Internesting Buffer (km)	Distance from Activity Area (~km)	Distance from Prelude (~km)
Green turtle	Ashmore Reef	Ashmore Reef and Cartier Reef	20	96	120
	Scott Reef – Browse Island	Scott Reef		120	180
		Browse Island		3	22
	North West Shelf	Mainland east of Mary Island to mainland adjacent to Murrara Island including all offshore islands		154	174
	Coburg Peninsula	Black Point to Smith Point, Croker Island and McCluer Island Group		963	986
Flatback	South-west Kimberley	Eighty Mile Beach, Eco Beach, Lacepede Islands	60	318	329
	Cape Domett	Cape Domett, Lacrosse Island		538	561
	Arafura Sea	Field Island, Bare Sand Island, Tiwi Islands, Cobourg Peninsula, Wessel Islands, Crocodile Island Group		681	705
Leatherback Turtle	Australia	Cobourg Peninsula and adjacent West Arnhem coastline to the east (including adjacent islands (e.g. Wessel Islands and Elcho Island)	20	919	940
Olive Ridley	Unknown genetic stock Kimberley, WA	Prior Point, Vulcan Island, Darcy Island, Llangi, Cape Leveque	20	161	178

Flatback Turtle

The flatback turtle (*Natator depressus;* Vulnerable, Migratory) is known to occur along the Western Australia, Northern Territory and Queensland coastlines, and forages widely across the Australian continental shelf and into the continental waters off Indonesia and Papua New Guinea (CoA 2017b). Flatback turtles are primarily carnivorous, feeding predominantly on soft-bodied invertebrates. Moderate to lesser density nesting in winter may occur in the North Kimberley offshore islands (Tucker et al. 2021). Flatback turtles that nest within the Pilbara region typically migrate along the continental shelf to foraging grounds as far north as Darwin at the end of the nesting season, returning to breed at varying intervals of a year or more (Thums et al. 2020; CoA 2017b).

There are no BIAs or habitats critical for the survival of flatback turtles within the Activity Area. There are BIAs and habitat critical for the survival of flatback turtles that overlap the Planning Area (see Figure 7-18, Figure 7-24 and Table 7-14).

Flatback turtles are unlikely to occur within the Activity Area, but are expected to occur within the Planning Area, particularly in suitable foraging habitat in coastal waters and around nesting beaches.

Green Turtle

The green turtle (*Chelonia mydas;* Vulnerable, Migratory) are predominately found off the WA, NT and Qld coastlines (CoA 2017b). The green turtle is the most common marine turtle breeding in the NWMR, with WA supporting one of the largest remaining populations worldwide (DSEWPaC 2012c). The species is primarily herbivorous and forages on algae, seagrass and mangroves, including where these habitats exist at offshore coral reef habitats across most of north-western Australia (Ferreira et al. 2021; CoA 2017b). Green turtles are also known to travel large distances of up to 3,100 km between nesting and feeding areas (Ferreira et al. 2021; DSEWPaC 2012c). This species breeds all year around, with nesting in the Kimberley region peaking in summer. The highest density rookery was found to be the Lacepede for green turtles, with moderate to lesser density nesting by green turtles in the North Kimberley offshore islands (Tucker et al. 2021).

There are no BIAs or habitats critical for the survival of green turtles within the Activity Area. There are BIAs and habitat critical for the survival of green turtles that overlap the Planning Area (see Figure 7-19, Figure 7-24 and Table 7-14).

Green turtles may occur throughout the Activity Area but would only be expected to occur in low numbers due to the absence of foraging or nesting habitat. Green turtles may be present throughout the Planning Area and are likely to be more abundant around nesting beaches and shallow foraging habitats.

Hawksbill Turtle

The hawksbill turtle (*Eretmochelys imbricata;* Vulnerable, migratory) predominately occur along the northern WA, NT and Qld coastlines, with three recognised stocks: north Qld stock located in the north Great Barrier Reef and Torres Strait; north-east Arnhem Land stock in the NT; and WA stock located on the NWS. On a global scale, WA provides one of the largest remaining hotspots for this species and migrating hawksbill turtles traverse shallow continental-shelf waters of <200 m deep following the coastline and a migratory corridor along the Pilbara coast (Fossette et al. 2021). Hawksbill turtles are omnivorous and feed on algae, sponges, soft corals and soft- bodied invertebrates foraging in waters ranging from 1.5 m to 84 m deep (Fossette et al. 2021). Hawksbill turtles are typically associated with rocky and coral reef habitats, often returning to a small foraging area, and are expected to be found within these habitats along the WA coastline, from Shark Bay to the northern extent of the NWMR, migrating over 4,600 km from their nesting site (Crommenacker et al. 2022; Barr et al. 2021; CoA 2017b).

There are no BIAs or habitats critical for the survival of hawksbill turtles within the Activity Area. There are BIAs that overlap the Planning Area (see Figure 7-20, Figure 7-24, and Table 7-14).

Hawksbill turtles may occur throughout the Activity Area but would only be expected to occur in low numbers due to the absence of foraging or nesting habitat. Hawksbill turtles may be present throughout the Planning Area and are likely to be more abundant around nesting beaches and shallow foraging habitats.

Loggerhead Turtle

Loggerhead turtles (*Caretta caretta;* Endangered, migratory) occur along most of the Australian coastline and throughout the NWMR (CoA 2017b). Capable of large migrations, individual loggerhead turtles from eastern

Australian have been recorded foraging in the NT and further afield in Indonesia and Papua New Guinea (Perez et al. 2022). In the Kimberley region, loggerhead turtles are thought to be transient or end-of-migration foragers with no documented nesting sites in the area (Tucker et al. 2021). This species is carnivorous and mainly feeds on benthic invertebrates in a wide range of habitats from nearshore to waters 55 m deep (CoA 2017b).

There are no BIAs or habitats critical for the survival of loggerhead turtles within the Activity Area. There are BIAs that overlap the Planning Area (see Figure 7-21, Figure 7-24 and Table 7-14).

Leatherback Turtle

Leatherback turtles (*Dermochelys coriacea;* Endangered, Migratory) are known to forage and migrate throughout the open offshore waters of Australia, with foraging more common along the east coast and Bass Strait. Records of leatherback turtles nesting in Australia are sparse, and limited to Qld, NSW and NT (DoE 2023w; CoA 2017b). There have been no confirmed accounts of nesting on WA beaches (Tucker et al. 2021), although they have been recorded in coastal waters of south-western WA. Leatherback turtles are pelagic throughout their life and feed almost exclusively on jellyfish (DoE 2023w; CoA 2017b).

There are no BIAs or habitats critical for the survival of leatherback turtles within the Activity Area. There are BIAs and habitat critical for the survival of leatherback turtles that overlap the Planning Area (see Figure 7-22, Figure 7-24 and Table 7-14). Leatherback turtles may occur within the Activity Area and Planning Area in low numbers throughout the year.

Olive Ridley Turtle

Olive ridley turtles (*Lepidochelys olivacea;* Endangered, migratory) are known to nest in the NT and on western Cape York (Qld), with low density nesting recorded on the Kimberley coast, in the Dampier Peninsula and along Camden Sound (Tucker et al. 2021; CoA 2017b). This species is primarily carnivorous and feeds on soft-bodied invertebrates in waters between 15 m and 200 m in depth. Olive ridley turtles can migrate through oceanic waters and have been recorded travelling up to 1,130 km between their nesting and foraging grounds (Cáceres-Farias et al. 2022; CoA 2017b; Whiting et al. 2005).

There are no BIAs or habitats critical for the survival of olive ridley turtles within the Activity Area. There are BIAS and habitat critical for the survival of olive ridley turtles that overlap the Planning Area (see Figure 7-23 and Table 7-14).

Olive ridley turtles may occur within the Activity Area and the Planning Area but are only expected to be present in low numbers.

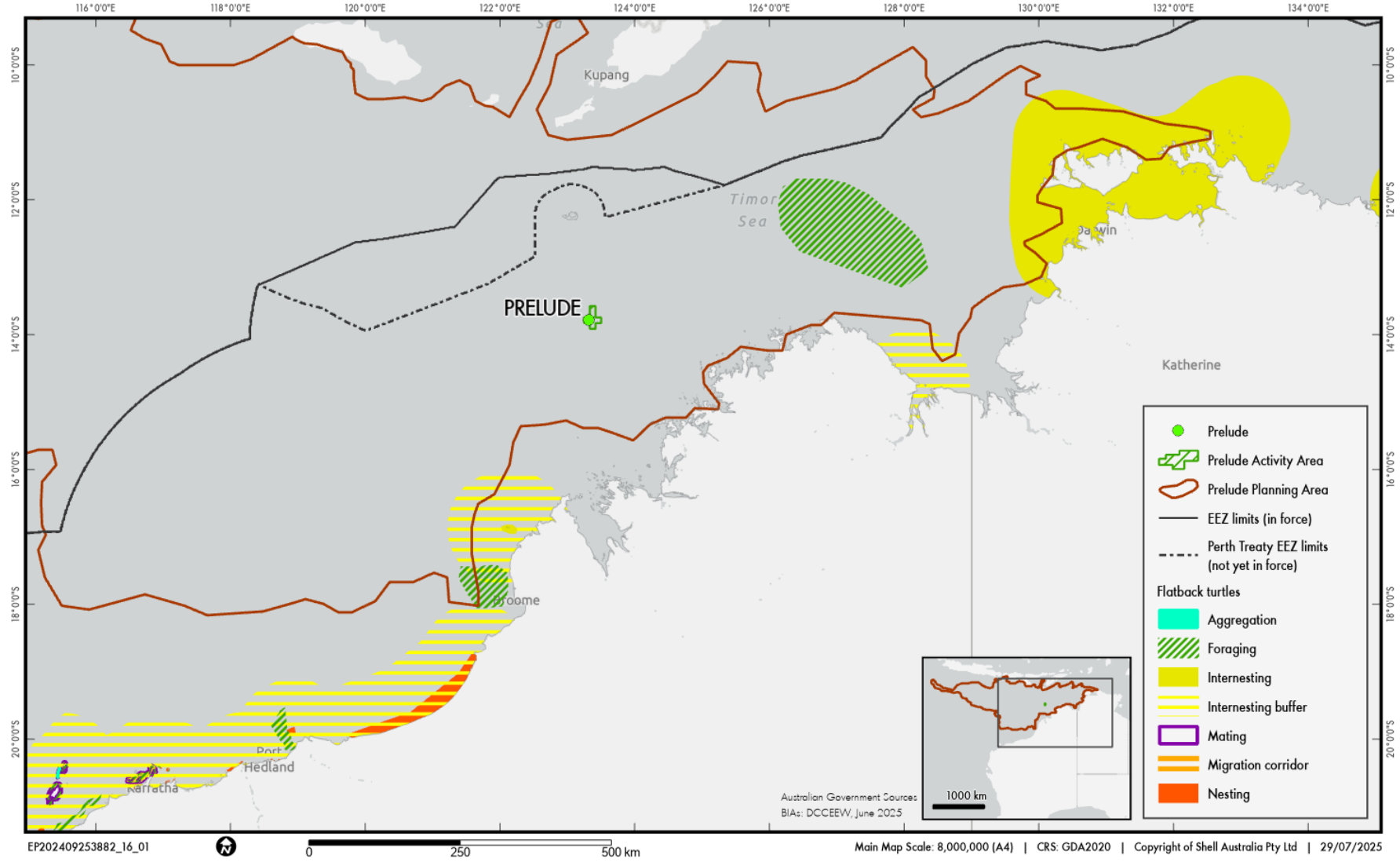


Figure 7-18: BIAs for Flatback turtles within the Planning Area

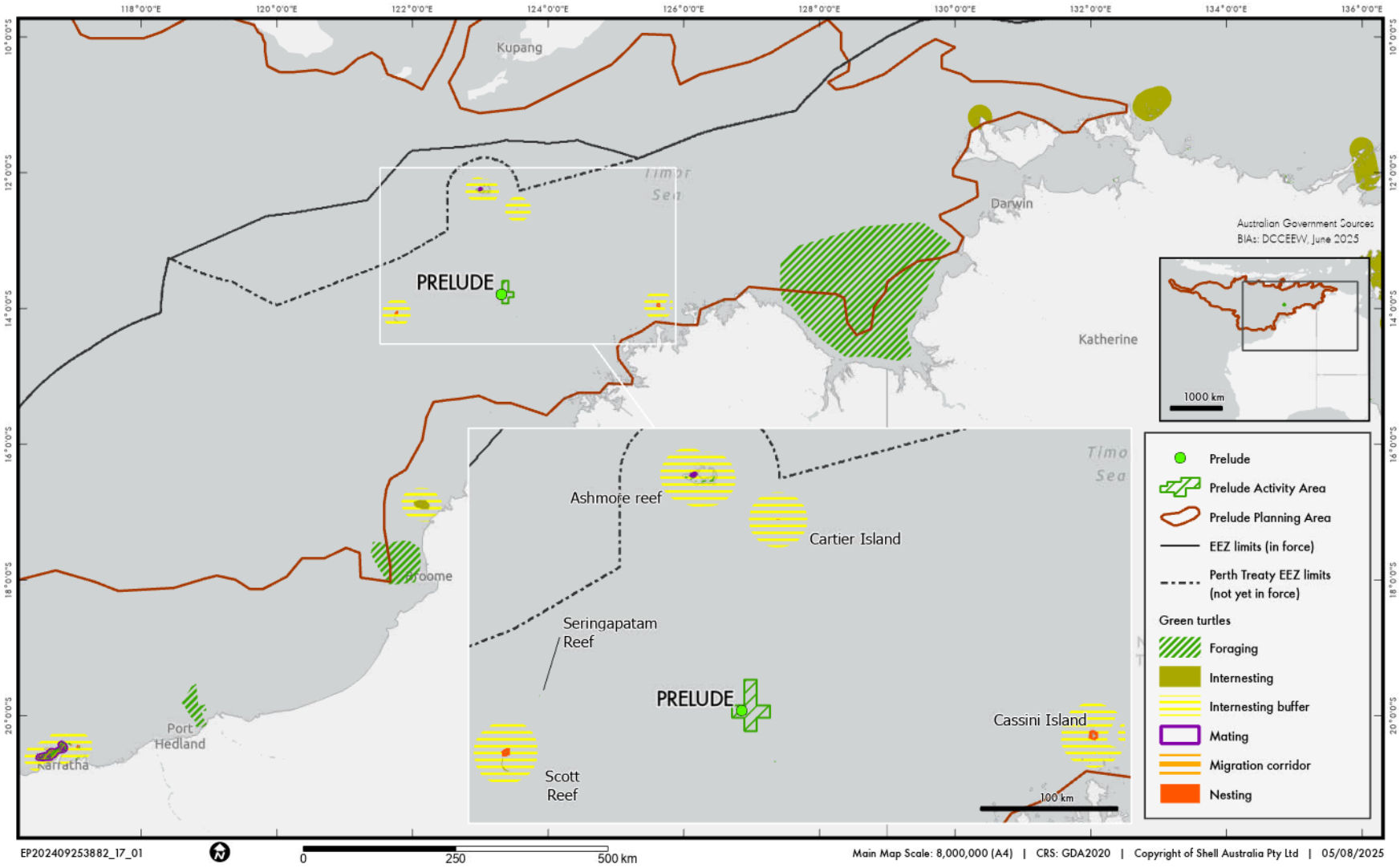


Figure 7-19: BIAs for Green Turtles within the Planning Area

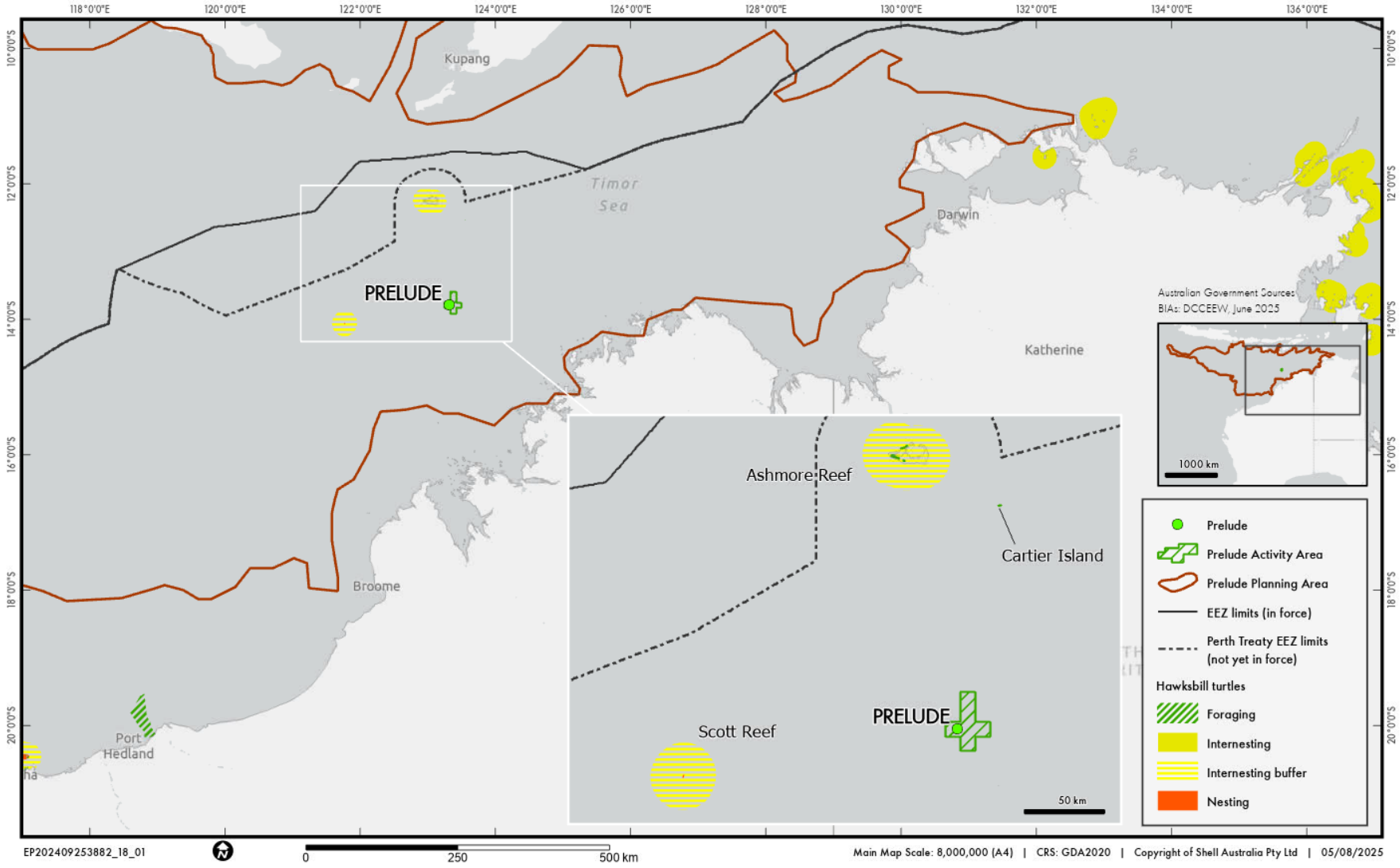


Figure 7-20: BIAs for Hawksbill Turtles within the Planning Area

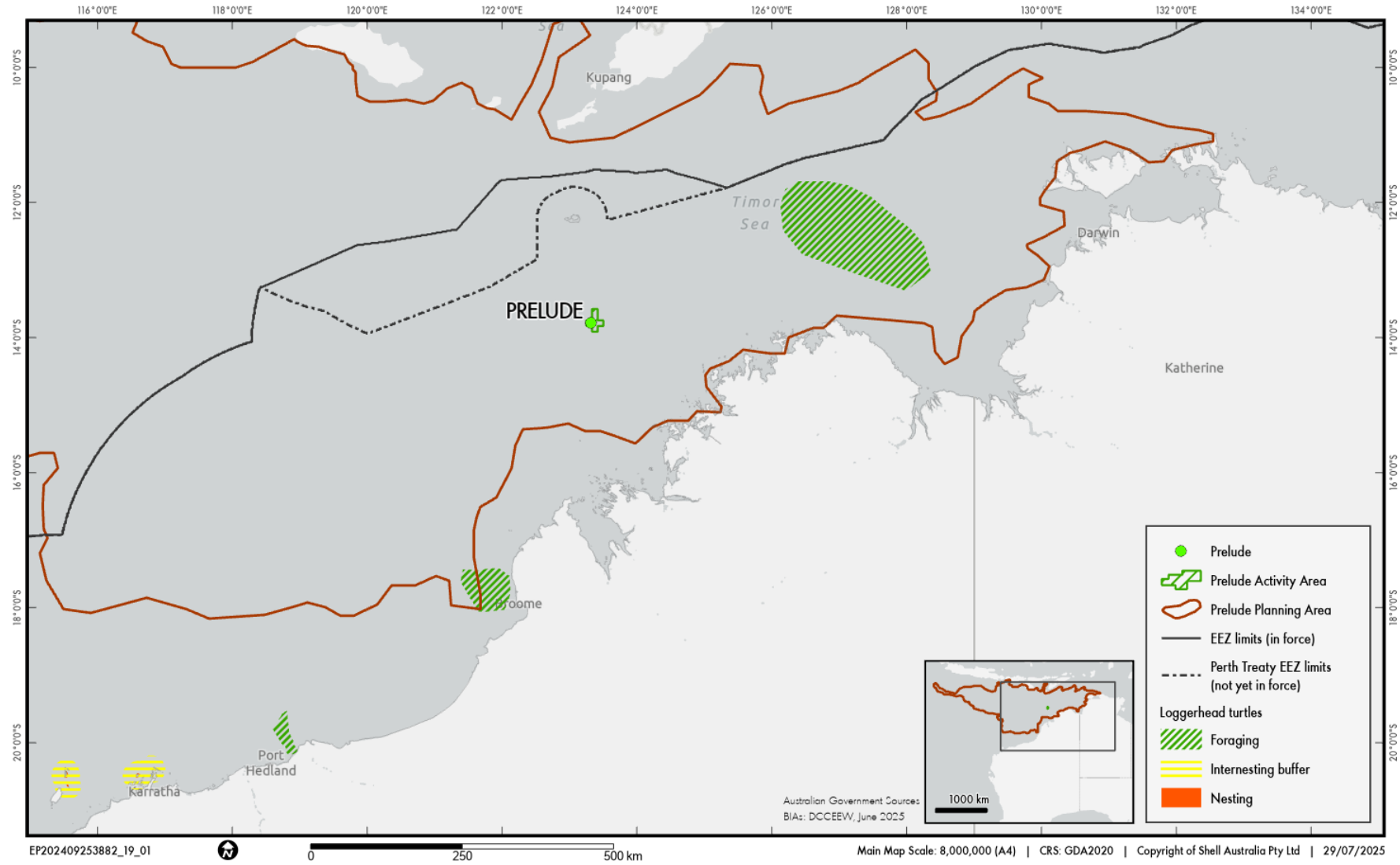


Figure 7-21: BIAs for Loggerhead Turtles within the Planning Area

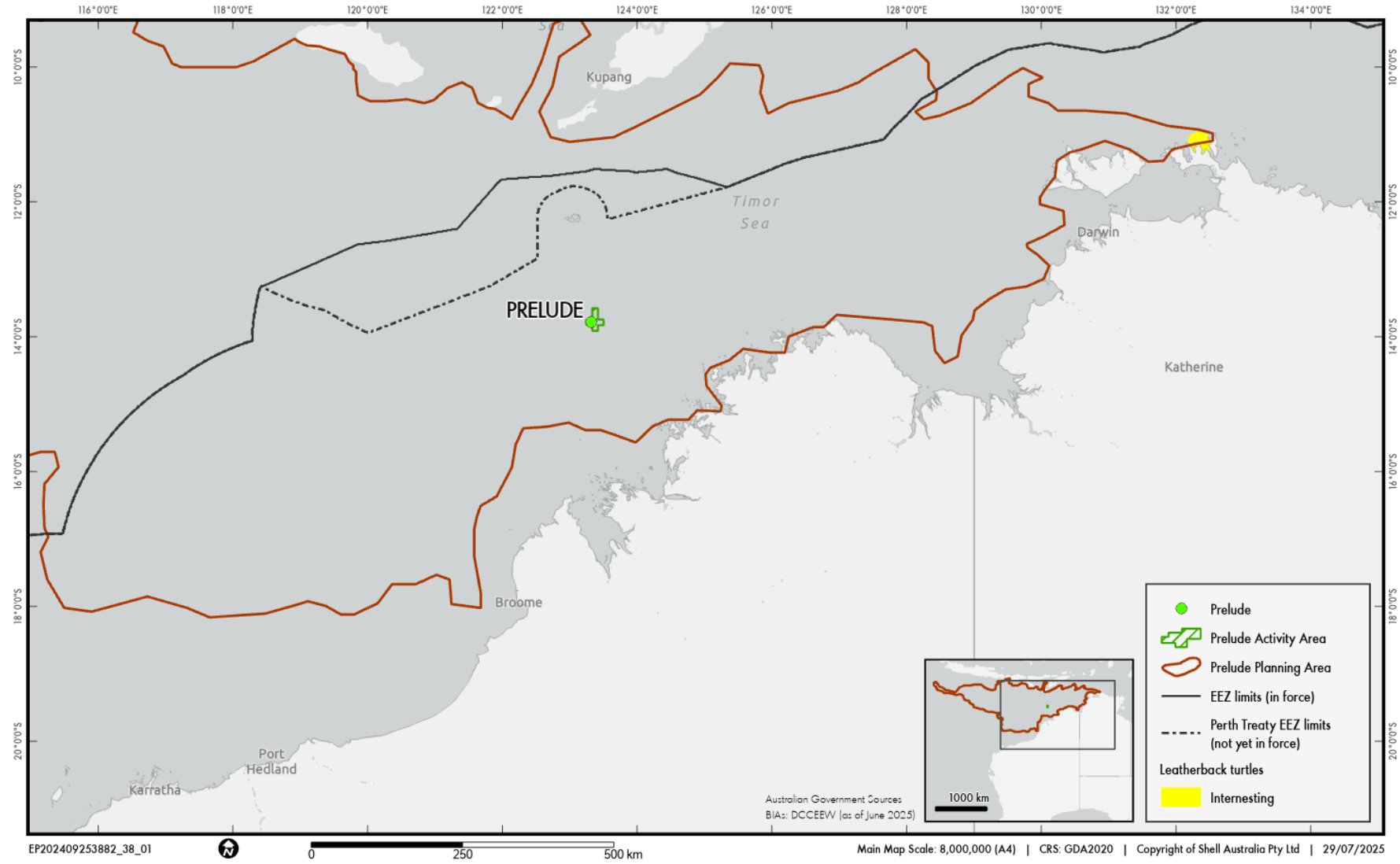


Figure 7-22: BIAs for Leatherback Turtles within the Planning Area

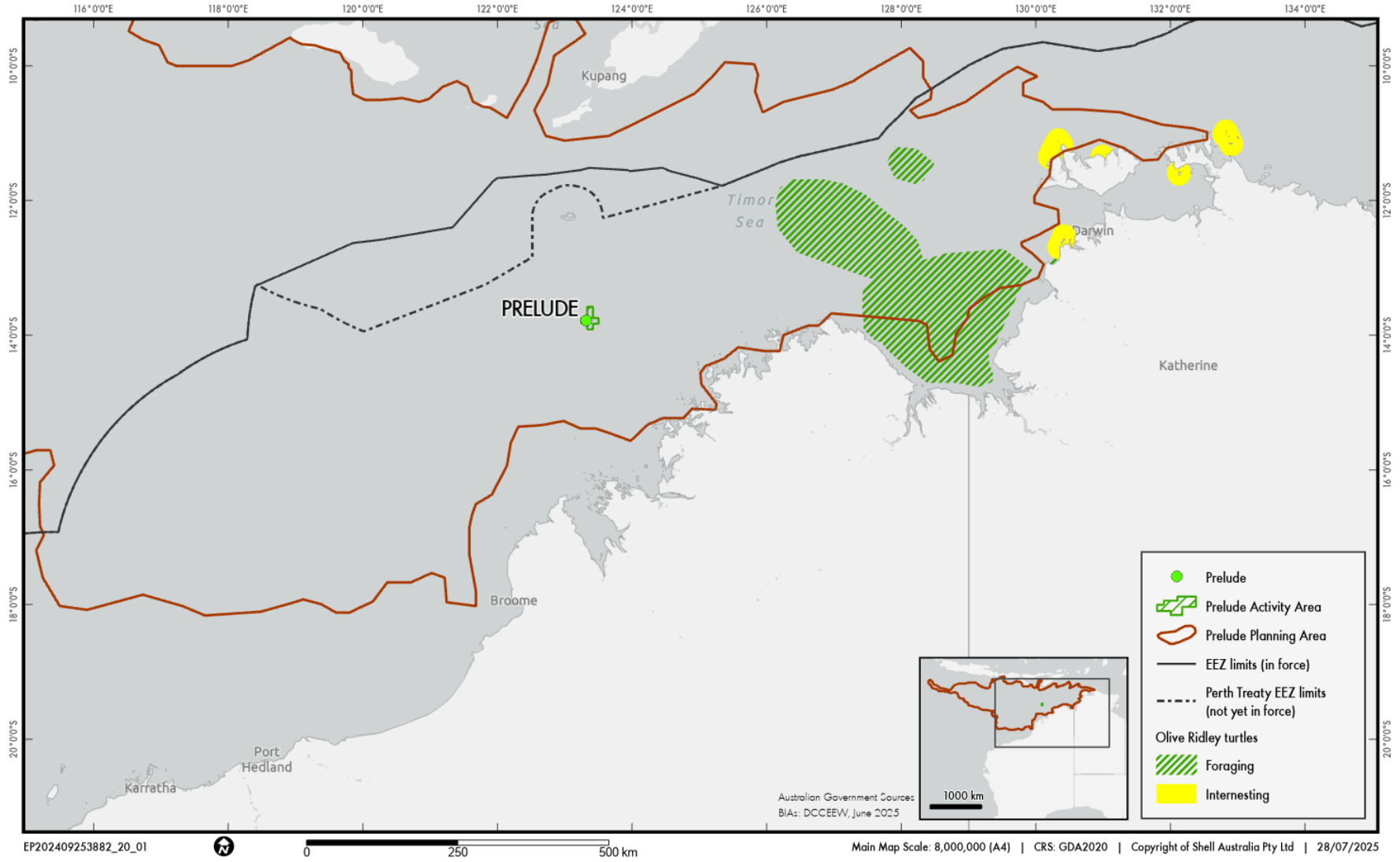


Figure 7-23: BIAs for Olive Ridley Turtles in the Planning Area

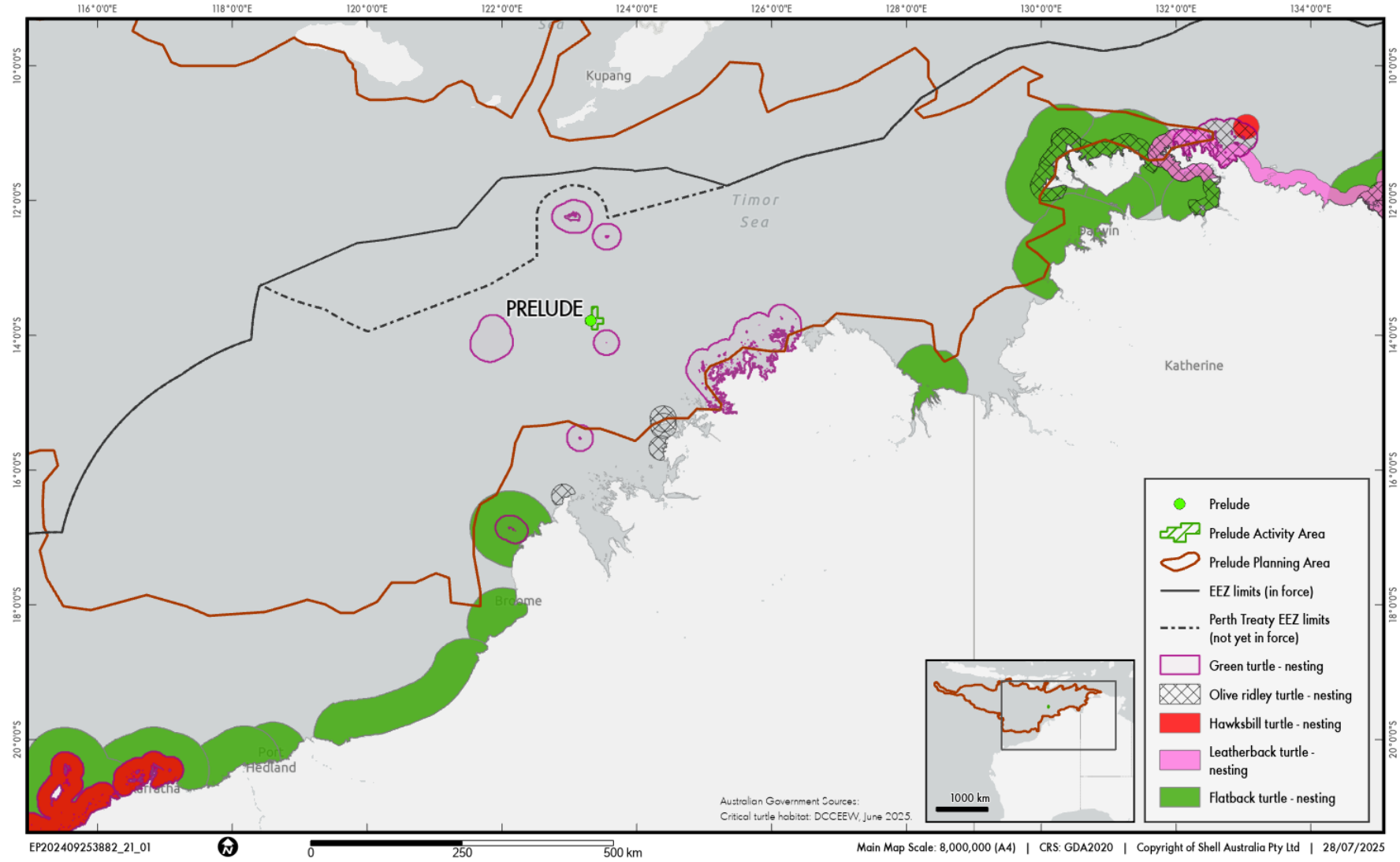


Figure 7-24: Habitat Critical for the Survival of Marine Turtles within the Planning Area

7.7.10.2.2 Sea snakes

There are three EPBC Act listed threatened sea snake species—dusky (*Aipysurus fuscus;* vulnerable), leaf-scaled (*Aipysurus foliosquama;* critically endangered) and short-nosed (*Aipysurus apraefrontalis;* critically endangered)—that are likely to occur within the Planning Area. These species are thought to be short-range endemic species and within the Planning Area are likely to be restricted to the Sahul Shelf within 0-20 m water depth (Lukoschek et al. 2013; Udyawer et al. 2020 as cited in DCCEEW 2024l). The leaf-scaled and short-nosed sea snakes have been recorded at Ashmore and Hibernia reefs, located ~168 km and 199 km north of the Prelude, respectively (TSSC 2010a, 2010b). In addition to these reefs, the dusky sea snake has been recorded at the Scott Reef complex and nearby Seringapatam Reef, Heywood Shoals and Cartier Island, located ~149 km, ~140 km, ~84 km and ~140 km from Prelude (DCCEEW 2024l). The short-nosed and leaf-scaled sea snakes have been sighted at Ningaloo Reef, some 1,500 km south-south-west of the Planning Area (D'Anastasi 2016). A leaf-scaled sea snake was also observed in seagrass meadows in Shark Bay (D'Anastasi 2016). These species prefer reef flats or shallow waters along the outer reef edge, in water depths up to 10 m (TSSC 2010a, 2010b). While once relatively common at Ashmore and Hibernia reefs, these sea snakes have not been recorded at these locations since the late 1990s/2001, despite an increase in survey effort (TSSC 2010a, 2010b; Speed et al. 2020, as cited in DCCEEW 2024l; Somaweera et al. 2021, as cited in DCCEEW 2024l). The decline of sea snakes at Ashmore Reef is likely due to a number of factors, with a variety of explanations being investigated including disease, increased predation from reduced shark fishing, higher water temperature, and more marine vessel traffic (Lukoschek et al. 2013; Somaweera et al. 2021; Speed et al. 2022; Guinea 2013, as cited in DCCEEW 2024l).

7.7.10.2.3 Crocodiles

Saltwater Crocodile

The salt-water crocodile (*Crocodylus porosus*; migratory) was listed under the EPBC Act to regulate commercial hunting which caused a significant decline in the population (DCCEEW 2024j). Salt-water crocodiles are found across northern Australia and occur within the nearshore marine and estuarine waters of the Kimberley coast (DCCEEW 2024j). Larger populations within the major river systems of the Kimberley occur in the rivers draining into the Cambridge Gulf, the Prince Regent and Roe River systems of the east and northwest Kimberley (all outside the Planning Area) (DCCEEW 2024j). There is limited availability of nesting habitat for this species within its distribution, with only the Ord, King and Roe River systems (outside the Planning Area) typically providing suitable nesting vegetation for the species (DCCEEW 2024j). There are no BIAs for the salt-water crocodile within the Planning Area, but given their widespread distribution, they are likely to be present within the Planning Area and or Activity Area, with a sighting of a saltwater crocodile off Prelude reported in April 2025.

7.7.10.3 Sharks, Rays and Other Fish

The Planning Area supports a variety of fish, shark and ray species of high conservation value, as well as fisheries of commercial and recreational importance. The current state of knowledge of fishing activities within the Planning Area in a socioeconomic context is discussed further in Section 7.8.2. Table 7-12 lists the EPBC Act listed threatened and migratory sharks, rays and other fish that may occur within the Planning Area. A foraging BIA for the whale shark intersects the Planning Area (Figure 7-25).

7.7.10.3.1 Fish

Fish Communities at Shoals

Fish communities found at the submerged shoals within the Planning Area are described in Section 7.7.3. In summary, the pelagic biota of the shoals was found to be similar to those on coral reefs and biologically rich. Of the species recorded, 97% were teleost fish with the remainder consisting predominantly of sharks and rays.

7.7.10.3.2 Sharks and Rays

Grey Nurse Shark (West Coast Population)

The grey nurse shark *(Carcharias taurus;* vulnerable) has a wide but patchy tropical and temperate distribution in the Indo-West Pacific and Atlantic oceans. There are two distinct Australian subpopulations: east coast and west coast. The west coast population inhabits coastal and continental shelf waters from SW WA (Albany) up

to the NW shelf (DoE 2023s; FRDC 2023) and although one aggregation site has been documented, data on spatial temporal distribution along the WA coastline is lacking (Hoschke et al. 2023). Grey nurse sharks undertake large-scale movements to potentially capitalise on seasonal prey aggregations, with individuals migrating 1,294 km along the WA coast from SW WA to Ningaloo (Jakobs et al. 2019; DoE 2023s). Grey nurse sharks are thought to move further north along the coast with lower sea temperatures from May to December, and individuals have been caught near Browse Island and off Bali, Indonesia (Hoschke et al. 2023).

No BIAs for grey nurse sharks occur within the Activity Area or the Planning Area. Given the species' preference for temperate waters, it is unlikely to occur within the Activity Area or Planning Area.

Manta Rays

The giant manta ray (*Mobula birostris*; migratory) and reef manta ray (*Mobula alfredi*; migratory) are globally distributed in both tropical and temperate waters. Giant manta rays are considered to be the more migratory and oceanic species of the two, and individuals of this highly-mobile species are not expected to be resident in Australian waters (Kyne et al. 2021a; Couturier et al. 2015). While considered more solitary and less frequently sighted than reef mantas, giant manta rays can be found in large numbers engaging in foraging, mating or cleaning activities and exhibit seasonal habitat preferences frequenting offshore seamounts and islands (Marshall et al. 2022a).

The reef manta ray typically uses productive nearshore habitats, including island groups, atolls and continental coastlines (Marshall et al. 2022b), and is coastally distributed across the north of Australia to ~30°S on both coasts (Armstrong et al. 2020). While reef mantas demonstrate a high degree of site fidelity in tropical and subtropical waters, this species has also been shown to travel up to 700 km, undertake seasonal migrations and traverse international waters (Couturier et al. 2015). Reef mantas are also often sighted in high numbers, predominately when undertaking foraging activities or migrating. There are no known foraging or breeding aggregation areas for these species within the Planning Area.

Oceanic Whitetip Shark

The Oceanic Whitetip Shark (*Carcharhinus longimanus*; migratory) is a highly mobile globally distributed pelagic species found in tropical and warm temperate waters 30°N to 35°S (DoE 2023n; Kyne et al. 2021a). This species is found from surface waters to at least 150 m deep and may venture close inshore where the continental shelf is narrow.

In Australia, this rarely encountered species is found in warmer waters from Cape Leeuwin in WA across northern Australia down to Sydney. The southern distribution limit is unclear with a single specimen recorded in South Australia. Oceanic whitetip sharks have been globally assessed as Critically Endangered by the IUCN, Overfished by the Status of Australian Fish Stocks (SAFS) and listed on Convention on International Trade in Endangered Species (CITES) Appendix II (FRDC 2023).

Sawfish

Three listed threatened sawfish species—dwarf sawfish (*Pristis clavata*; vulnerable, migratory), green sawfish (*Pristis zijsron;* vulnerable, migratory) and largetooth sawfish (*Pristis pristis*; endangered, migratory)—occur within the Planning Area. Adults of both green and largetooth sawfish are thought to use deepwater habitats, but this has not been confirmed for dwarf sawfish (CoA 2015b). Considering declining global populations of these sawfishes, northern and north-west Australia may contain the last significant populations of these species (Yan et al. 2021; CoA 2015b; DSEWPaC 2012e; DCCEEW 2025).

The dwarf sawfish is primarily found in shallow coastal and estuarine areas, from Cairns (QLD) around the north of Australia to the Pilbara coastline in WA, with juveniles thought to remain in estuarine waters (FRDC 2023; TSSC 2009).

The green sawfish does not occupy freshwater habitats and although most common in shallow coastal and estuarine areas, this species has been recorded in depths of up to 70 m from Cairns (Qld) across to Broome (WA) (FRDC 2023; TSSC 2008b).

The largetooth sawfish inhabits the sandy or muddy bottoms of river, estuarine and marine environments within north-west Australia and has a patchy distribution, including the Fitzroy, Durack, Robinson and Ord rivers in WA. Newborns and juveniles occur primarily in the freshwater areas of rivers and in estuaries, while adults

mostly occupy marine and estuarine environments (FRDC 2023; CoA 2015b; DSEWPaC 2012e; TSSC 2014b).

The narrow sawfish (*Anoxypristis cuspidate*; migratory) a bentho-pelagic species found throughout the Indo-West Pacific and are still found throughout much of its historic range, albeit in substantially reduced numbers (FRDC 2023). Narrow sawfish occur across northern Australia from the Pilbara Coast (WA) to Broad Sound (Qld) in waters up to 40 m deep on the continental shelf and in estuaries (Kyne et al. 2021a; FRDC 2023). Juveniles and pupping females require inshore and estuarine habitats, while adults predominantly occur offshore (FRDC 2023).

There are no known foraging or breeding aggregation areas for these species within the Planning Area.

Scalloped Hammerhead Shark

The Scalloped Hammerhead shark (*Sphyrna lewini*; conservation dependent) is a coastal and semi-oceanic species with a wide tropical and warm-temperate global distribution from the intertidal zone to at least 275 m water depth, with newborns found in coastal zones (Kyne et al. 2021a; FRDC 2023). Recent studies suggest that the Indo-Pacific population (including Australia) is genetically distinct from the Atlantic and Caribbean populations. There is likely to be two subpopulations in Australian waters (WA and the rest of Australia), with the non-WA subpopulation connected to Papua New Guinea and Indonesia by shallow water habitats along northern Australia (Green et al. 2022). This mobile species has a broad Australian range from NSW and Qld across the NT to WA (DoE 2023o; Bartes et al. 2021; Kyne et al. 2021a; FRDC 2023).

Shortfin Mako Shark and Longfin Mako Shark

Shortfin mako (*Isurus oxyrinchus*; migratory) and longfin mako (*Isurus paucus*; migratory) sharks are both highly migratory epipelagic species. The shortfin mako is a common shark widespread in tropical and temperate waters with temperatures above 16 °C (Groeneveld et al. 2014). This species is widespread throughout Australian waters except for the Torres Strait, Arafura Sea and Gulf of Carpentaria (FRDC 2023; Birkmanis et al. 2020; Kyne et al. 2021a). Shortfin mako sharks exhibit sexual and developmental segregation; juveniles spend 90% of their time near the surface whereas adults dive much deeper (Groeneveld et al. 2014). In contrast, the wide but patchy distribution and biology of the rarely encountered longfin mako is less well documented (Kyne et al. 2021a). This epipelagic shark also inhabits tropical and warm-temperature waters (Reardon et al. 2006) and longfin mako sharks are found in Australia from Geraldton in WA across the Northern Territory and Queensland down to Port Stevens in NSW (FRDC 2023).

Speartooth Shark and Northern River Shark

Sharks of the *Glyphis* genus are considered among the most threatened elasmobranch species worldwide and estimated population sizes are small. Two species occur in macrotidal rivers and estuaries of northern Australia and southern Papua New Guinea (Kyne et al. 2021b; Stevens et al. 2005).

The speartooth shark (*Glyphis glyphis;* Critically Endangered) has been recorded as occurring in macrotidal rivers and estuaries environments, with juveniles and sub-adults utilising large tropical river systems as their primary habitat (Kyne et al. 2021b; CoA 2014b; Stevens et al. 2005). It is thought that their marine distribution may be limited to the coastal marine environment outside of rivers, much like that of the bull shark (FRDC 2023; CoA 2014b). While the speartooth shark is known to inhabit the Wenlock/Ducie/Port Musgrave river system in Qld and various rivers of the Van Diemen Gulf in the NT, new populations of this species were recently discovered in the Daly River, NT and the Ord River, WA (Kyne et al. 2021b).

Northern river sharks (*Glyphis garricki*; endangered) are rare and although their distribution is uncertain, they are known to occur in the Ord and King Rivers, King Sound and Joseph Bonaparte Gulf in WA along with the South and East Alligator Rivers and the Wessel islands in NT (FRDC 2023; TSSC 2014a; CoA 2014a). It is thought that this species exhibits segregation during developmental stages and similarly occupies rivers, estuarine systems, macrotidal embayments, as well as inshore marine habitats (Kyne et al. 2021b; FRDC 2023; CoA 2014a). Although the northern river shark has been recorded in offshore waters, the frequency of this occurrence is unknown.

Remaining populations throughout Australia are considered isolated and their viability is therefore questionable. Both species were listed as threatened in 2001 due to their limited geographical distribution and low population estimates, and the population decline is likely to continue (TSSC 2014).

There are no BIAs for these species within the Activity Area or Planning Area.

White Shark

The white shark (*Carcharodon carcharias*; vulnerable, migratory) is a rare, primarily temperate species with a wide Australian range and two subpopulations; eastern Australasia (from Papua New Guinea along Australia's east coast and Macquarie Island to the south-western Pacific, including waters off New Caledonia, Vanuatu and Tonga) and the southern-western population (from western Victoria across southern Australia and up the WA coast) (DSEWPaC 2013; FRDC 2023; Kyne et al. 2021a). Although the species has been recorded up to Ningaloo Reef (WA) and may occur further north (McAuley et al. 2017), white sharks are not known to aggregate within the NWMR or NMR and are most likely to be found south of NW Cape (DSEWPaC 2012, 2012e). Ongoing research into the movements of this species suggests that female white sharks travel further offshore than males, cover a broader longitudinal range and dive deeper (Bradford et al. 2020). Off the WA coast, the direction and timing of the movement of individual sharks are highly variable, with white sharks travelling along the coast in both directions at most times of the year. The reasons for movements to north-western WA are unknown and little information is available on their reproduction in Australian waters (McAuley et al. 2016; DSEWPaC 2012e).

There are no BIAs for white sharks within the Activity Area or Planning Area; given the anti-tropical distribution of this species, white sharks are unlikely to occur in the Activity Area or Planning Area.

Whale Shark

The whale shark (*Rhincodon typus*; vulnerable, migratory) is globally distributed in tropical and warm temperate seas, with the exception of the Mediterranean. There are two distinct subpopulations, with approximately 75% of the global population in the Indo-Pacific, and the remaining 25% in the Atlantic Ocean (Vignaud et al. 2014 in FRDC 2023). A known whale shark aggregation and congregation site are located at Ningaloo Reef (WA) and near Christmas Island (WA) respectively (both outside of the Planning Area). These aggregations are thought to be linked to seasonal prey fluctuations (DoE 2015e; DEH 2005). The species is an epipelagic filter feeder with a diet of planktonic and nektonic species, including small crustaceans and smaller schooling fish species (DoE 2023p). Whale sharks are known to be highly migratory with migrations of over 20,000 km recorded (Guzman et al. 2018). Migration along the northern WA coastline broadly follows the 200 m isobath and typically occurs between July and November (DoE 2015e).

A known foraging BIA for whale sharks is located in northern WA, offshore of the Pilbara and Kimberley coastline, and broadly follows the 200 m isobath (Figure 7-25; DoE 2023p). The BIA is listed as a foraging habitat, however the Conservation Advice (DoE 2015e) for this species indicates this BIA up the northwest coast represents a migration corridor rather than significant foraging habitat, consistent with tagging studies. Meekan and Radford (2010) showed that whale sharks migrated up the coast from Ningaloo Reef and individually dispersed over a broad area, either north-west into the open Indian Ocean, northward towards Sumatra and Java, or north-east towards the Timor Sea. Thomson et al. (2021) more recently recorded whale sharks tagged in Ningaloo Reef travelling to the NWS. There is also a high-density foraging BIA along Ningaloo Reef (Figure 7-25; DoE 2023p). The Planning Area intersects these BIAs.

Based on tagging studies, a foraging BIA has been defined for whale sharks which extends along the continental slope between the Ningaloo Coast and the Timor Sea (Figure 7-25). While listed as a foraging BIA, it is more likely to represent a migration corridor for individual whale sharks moving between Indonesia and the Ningaloo Coast. The whale shark is known to occur within the Activity Area, with crew onboard the Prelude FLNG facility having observed the species.

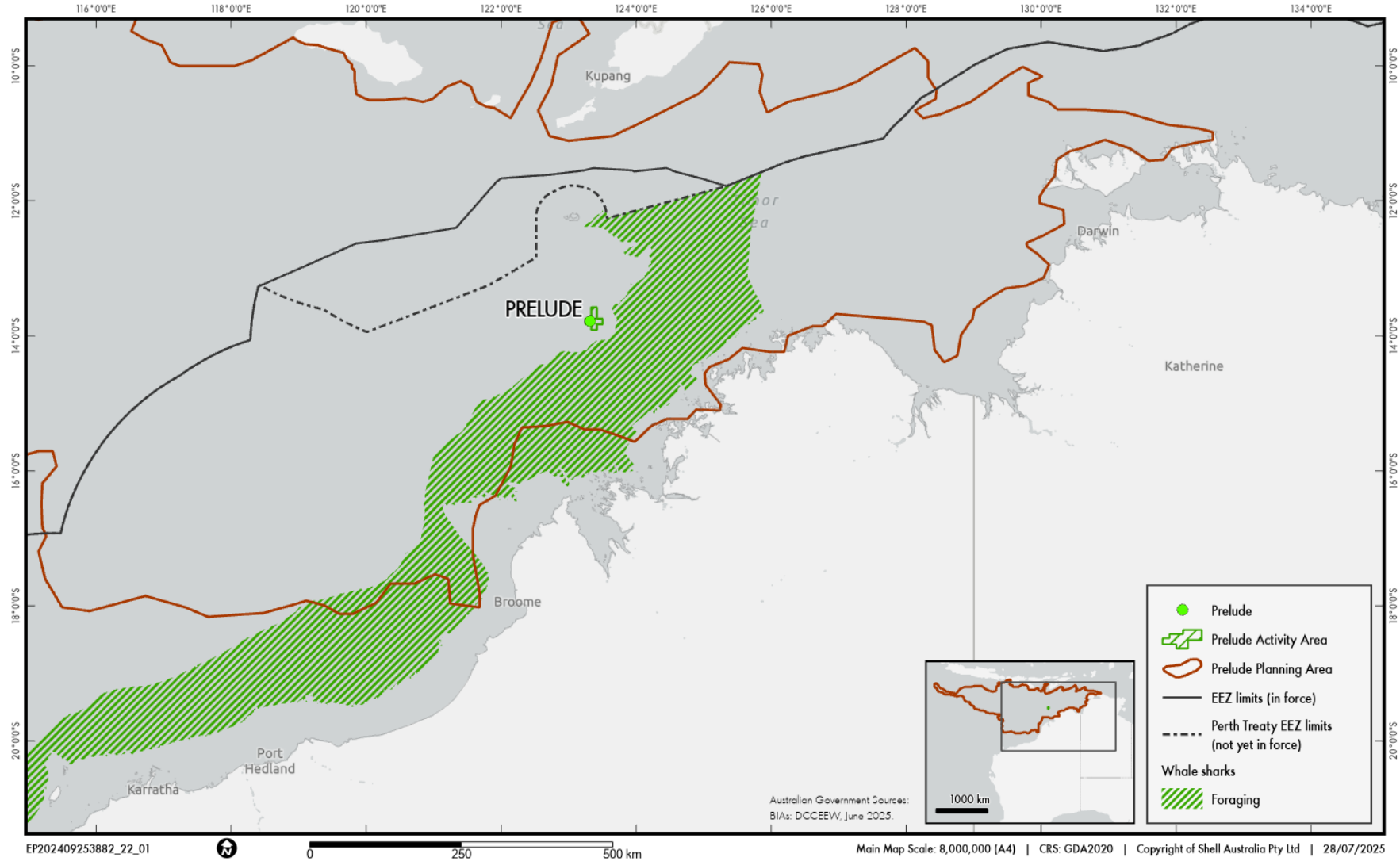


Figure 7-25: BIAs for Whale Sharks within the Planning Area

7.7.10.4 Birds

Table 7-12 lists the EPBC Act listed threatened and migratory birds that may occur within the Activity Area and Planning Area. A number of marine bird species are known to occur within the Planning Area as they forage large distances over the open ocean (DCCEEW 2024). Many migratory shorebird and wetland species are also expected to fly over the Planning Area as part of their large-scale transitory movements.

Most migratory birds are unlikely to land on the sea for significant periods of time (ConocoPhillips 2018). Whilst seabirds spend much of their lives at sea, migratory shorebirds overfly offshore areas during migratory periods and typically do not interact with the sea surface (DCCEEW 2024; ConocoPhillips 2018). Migratory wetland species also do not interact with open offshore waters. However, these species may land on offshore oil and gas infrastructure, especially during inclement weather, while flying between land masses (ConocoPhillips 2018).

No emergent land exists within the Activity Area that could support breeding populations of seabirds or migratory shorebirds. The nearest shorelines are Browse Island, Cartier Island and Ashmore Reef. Scott Reef and may provide additional connectivity for shorebirds of the NWMR (DCCEEW 2024).

Table 7-16 lists and Figure 7-26 shows the bird BIAs that may occur within the Planning Area.

Table 7-16: Bird BIAs within the Planning Area

Common Name	BIA Behaviour	BIA Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
Brown booby	Breeding	Breeding at Ashmore Reef. Breeding may occur from Feb–Oct.	97	119
Greater frigatebird	Breeding	Islands off the Kimberley (WA) coastline including Ashmore Reef and Adele Island (outside of the Planning Area). Breeding may occur in May–Jun and Aug.	37	57
Lesser crested tern	Breeding	Breeding along NT coastline and Ashmore Reef. Breeding may occur from Mar–Jun.	120	141
Lesser frigatebird	Breeding	Islands off the Kimberley (WA) coastline including Ashmore Reef and Adele (outside of the Planning Area) and Lacepede (outside of the Planning Area) Islands.	38	62
Little tern	Resting	Islands off the Kimberley (WA) coastline including Ashmore Reef.	133	154
	Breeding	Breeding along NT coastline. Breeding recorded from April to early January, with the main periods being late April-July and September-early January.	226	247
Red-footed booby	Breeding	Islands off the Kimberley (WA) coastline including Ashmore Reef and Adele Island (outside of the Planning Area). Breeding may occur in May–Jun.	37	57
Roseate tern	Breeding	Breeding along NT coastline and Ashmore Reef. Breeding may occur from Mar–Jul.	120	141

Common Name	BIA Behaviour	BIA Description	Distance from Activity Area (~km)	Distance from Prelude (~km)
Wedge-tailed shearwater	Breeding	Breeding at Ashmore Reef. Breeding may occur from Aug–Apr.	39	62
White-tailed tropicbird	Breeding	Breeding at Ashmore Reef. Breeding may occur from May–Oct.	46	65
Bridled tern	Breeding	Breeding along NT coastline. Breeding may occur March–November/December.	992	1008
Crested tern	Breeding	Breeding along NT coastline. Breeding may occur May–November.	982	1001
	Breeding (high numbers)		778	796

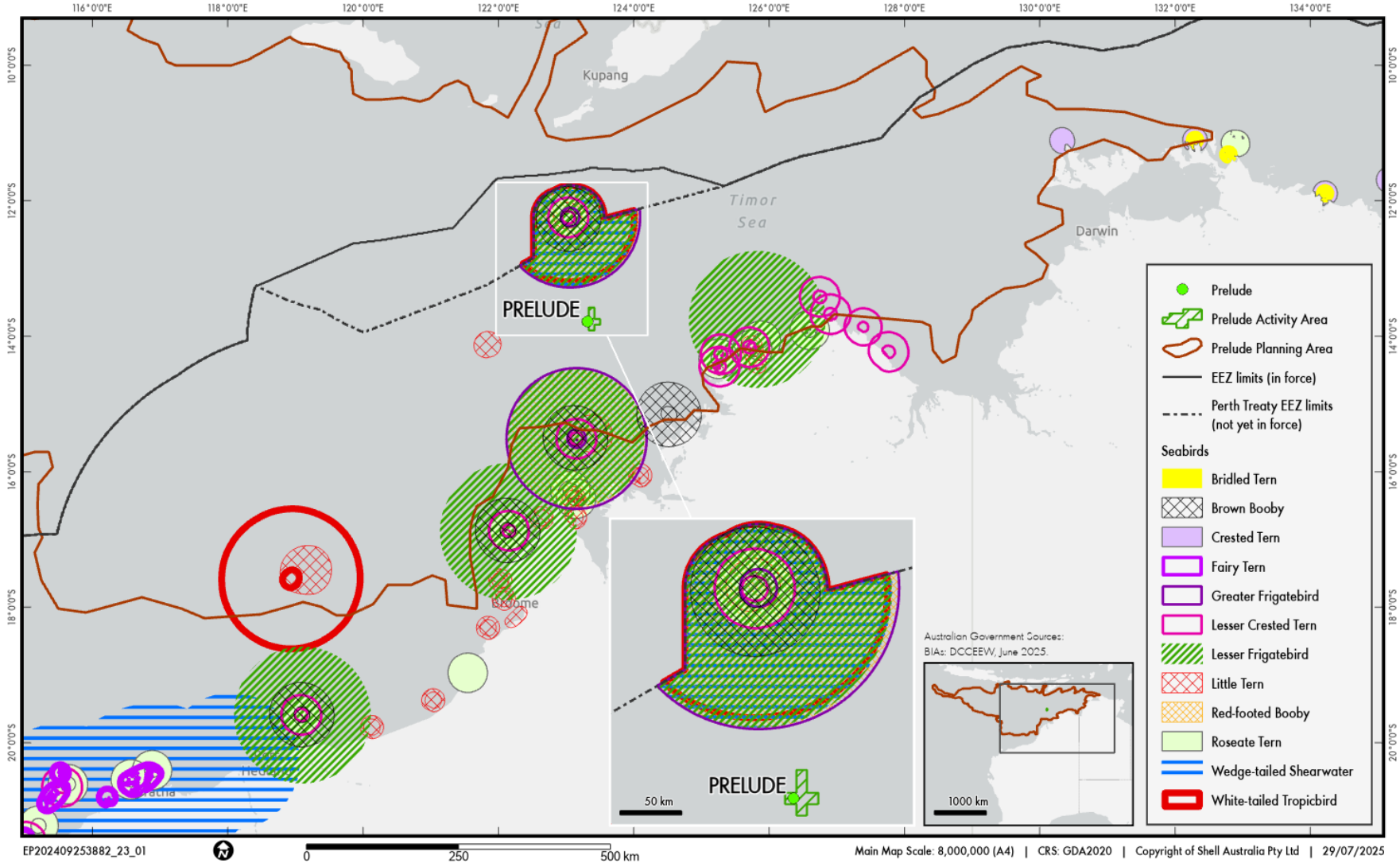


Figure 7-26: BIAs for Birds within or Proximal to the Planning Area

Abbott's Booby

The Abbott's booby (*Papasula abbotti*; endangered) spends the majority of its life at sea, generally only coming ashore to breed. Within Australia, this species breeds exclusively on Christmas Island (outside of the Planning Area), nesting in the forests on the island and foraging in the surrounding waters and south-east Asia (TSSC 2020). Recent population estimates on Christmas Island are of 2,500 breeding pairs (Menkhorst et al. 2017). The restricted geographical location of Abbott's booby is thought to be attributed to areas of upwelling in the waters surrounding Christmas Island, possibly providing seasonal prey items necessary for raising offspring.

Asian Dowitcher

The Asian dowitcher (*Limnodromus semipalmatus*; vulnerable under the EPBC Act, migratory) is a large, distinctive wader with a long neck, long legs, and a long, straight, snipe-like bill (DCCEEW 2024e). In Australia, this bird is only a regular visitor to coastal areas between Broome and Port Hedland and the Port McArthur tidal wetlands in the Gulf of Carpentaria, arriving from August (DCCEEW 2024e). It roosts in sheltered coastal environments such as estuarine and intertidal mudflats, lagoons, creeks and saltworks, and feeds on inter-tidal mudflats (DCCEEW 2024e). Only a small proportion of the non-breeding population arrive in Australia, occasionally recorded in the NT and rarely in western and eastern Australia (DCCEEW 2024e). In the NT, the Asian dowitcher is found in Darwin and Arnhem Land (DCCEEW 2024e). No sites of international significance are listed in the NT for this species (Birdlife Australia 2020). The Asian dowitcher typically leaves north-west Australia by the end of April to return to northern hemisphere breeding grounds (DCCEEW 2024e). Given the areas historically observed to be inhabited by this species, individuals may seasonally occur within the Planning Area.

Australian Lesser Noddy

The Australian lesser noddy (*Anous tenuirostris melanops*; vulnerable) is a tropical species of tern endemic to Australia (DoE 2023ab; TSSC 2015c). Whilst the Australian lesser noddy has a large range, the species primarily uses a small area in Houtman Abrolhos for breeding (DoE 2023ab; Surman et al. 2018; TSSC 2015c). The Australian lesser noddy is also known to breed in small numbers at Ashmore Reef (Menkhorst et al. 2017) and individuals generally remain in close proximity to the breeding islands throughout the year (Surman et al. 2018). Although the EPBC Act protected matters report states that breeding is known to occur within the area, Australian lesser noddies are likely to remain in the general vicinity or to the south of the Houtman Abrolhos Islands and are not expected to occur in significant numbers throughout the Planning Area.

Australian Painted Snipe

The Australian painted snipe (*Rostratula australis*; endangered) is a wading bird that has been recorded in wetlands of all Australian states, although in smaller numbers and less frequently at scattered locations in WA (DoE 2023ac; DCCEEW 2022a). This species generally inhabits shallow terrestrial freshwater and occasionally brackish wetlands and other waterlogged areas, requiring shallow wetlands with areas of bare wet mud and canopy cover nearby for breeding (DoE 2023ac; DCCEEW 2022a). The most northerly breeding records are from near Derby and Taylor's Lagoon, near Broome, although this species is only occasionally recorded in northern WA (DoE 2023ac; Trainor et al. 2017; Knuckey et al. 2013). The EPBC Act protected matters report states that this species or habitat may occur within the area, however, as the Australian painted snipe inhabits freshwater wetlands, it is unlikely to occur in the Planning Area.

Barn Swallow

The barn swallow (*Hirundo rustica*; migratory) usually occur in northern Australia, on Cocos-Keeling Island and Christmas Island (both outside of the Planning Area) (Stokes et al. 1984; Stokes 1988), Ashmore Reef (Higgins et al. 2006), and patchily along the north coast of the mainland from the Pilbara region (WA) to Fraser Island (Qld).

Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit, Northern Siberian Bar-tailed Godwit

Two subspecies of the bar-tailed godwit exist, as determined by their breeding locations in Siberia and Alaska (Bamford *et al*. 2008). Non-breeding birds migrate to the coasts of Australia. Northern Siberian bar-tailed godwit (*Limosa lapponica menzbieri*; endangered) and Alaskan bar-tailed godwit (*Limosa lapponica baueri;* migratory) are large migratory shorebirds that predominantly occur in the north and north-west of WA. The species has been recorded in the coastal areas of all Australian states and is widespread in the Torres Strait.

In WA, both species have been recorded along the coastline from Eyre to Derby and across northern Australia from Darwin east to the Gulf of Carpentaria and is a regular migrant to Christmas Island. The bar-tailed godwit is found in coastal habitats, sandy ocean beaches, coral reef-flats and rock platforms, foraging near the water's edge or in shallow water. This species feeds on worms, molluscs, crustaceans, insects and some plant material (Chan et al. 2022; DoE 2023al; DCCEEW 2024c, DCCEEW 2024d).

The Western Alaskan bar-tailed godwit (*Limosa lapponica baueri*, Endangered) breeds in the northern hemisphere and migrates southwards for the boreal winter, with most breeding individuals leaving south-eastern Australia by the end of the first week of April, and most of the remaining birds being immature individuals. Nunivak bar-tailed godwits eat molluscs, worms, crustaceans and insects caught when foraging in shallow water or along the edge of water, with a preference for exposed sandy or soft mud substrates on intertidal flats, banks and beaches (Chan et al. 2022; DoE 2023am, 2016e).

Black- tailed Godwit

Black-tailed godwits (*Limosa limosa*; Endangered, Migratory) are found in all states and territories of Australia during the non-breeding (austral summer) season, with coastal regions supporting the highest densities of the species. This bird usually first arrives in north-west Australia from late August, and most have departed the NT by mid-April (DCCEEW 2024b). The largest populations are found on the north coast between Darwin and Weipa (DCCEEW 2024b). Roosting usually occurs in sheltered bays, estuaries, and lagoons with large intertidal mudflats and/or sandflats. Feeding habitat includes areas of mud or soft, wet sand within sandflats, intertidal mudflats, saltmarshes, and the beaches of oceanic coastlines, bays, and estuaries (DCCEEW 2024b). Areas of importance to the species in the NT include Darwin Harbour, North Darwin (the Beagle Gulf coastline), Legune Wetlands and Milingimbi Coast, but none of these are considered to have international significance (Birdlife Australia 2020). The species may occasionally be seasonally present within the intertidal zones and shorelines within the EMBA.

Bridled Tern

Bridled terns (*Onychoprion anaethetus;* migratory) occur in warm tropical waters worldwide and are widespread in Australia, breeding on offshore islands from Cape Leeuwin in the south-west around the north to Qld. At sea, distribution extends from SW WA to Barrow Island and the Dampier Archipelago, and off the Kimberley coast west of the Dampier Peninsula to Ashmore Reef and Joseph Bonaparte Gulf. Breeding is widespread in the Pilbara and Kimberley Regions. In the NT, the main colonies are off north-eastern Arnhem Land, on south-eastern Groote Eylandt and the Sir Edward Pellew Group. This species spends a large portion of its life offshore and is rarely seen near land except when breeding. Bridled terns breeding seasons vary geographically, occurring in the spring and summer in WA, with most birds returning to their breeding grounds between late September/October and departing in April (DoE 2023at). The Planning Area overlaps a breeding BIA for the bridled tern and is included in Figure 7-26.

Brown Booby

The brown booby (*Sula leucogaster*; migratory) occurs from Bedout Island in WA, around the NT coast to Queensland. Off north-west WA, this species is most abundant 18–36 km from land and is often concentrated where wavelets are about 2m high. The brown booby breeds on tropical and continental islands, sand cays and atolls. This species feeds in both shallow and deep inshore waters on mullet, flying-fish, squid and cephalopods, caught by plunge-diving (2023as). A known breeding BIA for the brown booby overlaps the Planning Area and is included in Figure 7-26.

Caspian Tern

Caspian terns (*Hydroprogne caspia*; migratory) are widespread in Australia in both coastal and inland areas. In WA, the species is widespread in coastal regions from the Great Australian Bight to the Dampier Peninsula and are known to breed in the Pilbara region from Point Cloates to North Turtle Island, and more rarely in the Kimberley Region. In the NT, records are scattered but in the non-breeding season are more common on the eastern and western coasts. Caspian terns are known to breed on Sandy Island off Cobourg Peninsula, and on offshore islands including the Sir Edward Pellew Group. In Australia, this species is resident where breeding occurs year-round, but also where breeding is protracted (e.g. Darwin and WA). This species inhabits sheltered coastal embayments with sandy or muddy margins and prefers sheltered areas near offshore islands but is

rarely seen beyond reefs. Caspian terns forage in sheltered shallow water and open coastal waters for small fish, carrion and invertebrates (DoE 2023av).

Christmas Island Frigatebird

Christmas Island frigatebirds (*Fregata andrewsi*, Endangered, migratory) are mostly tropical and marginally subtropical seabirds with adaptions for highly specialised flying and aerial feeding. Although this species ranges widely throughout south-east Asia and the Indian Ocean, Christmas Island frigatebirds breed only on Christmas Island (DoE 2023ae; CoA 2020; McMaster et al. 2015). Breeding adults forage in different areas, commonly taking prey close to or from the water surface, with females foraging in the waters around Christmas Island during early chick rearing, and both sexes undertaking longer and further foraging trips as the chicks mature (CoA 2020). Individuals are known to forage and roost thousands of kilometres from Christmas Island, but there are only a handful of confirmed records from mainland Australia, with two from the Darwin coastline in the NT in 2014. McMaster et al. (2015) suggests that cyclonic activity and a strong monsoonal trough influenced the arrival of these individuals.

Christmas Island White-tailed Tropicbird

The Christmas Island white-tailed tropicbird (*Phaethon lepturus fulvus*; endangered) is a subspecies of *Phaethon lepturus*, however, there is dissent as to whether this species is merely a 'golden morph' of the white-tailed tropicbird (DoE 2023af; TSSC 2014c; Humeau et al. 2020). Christmas Island white-tailed tropicbirds disperse widely to roost and forage over the Indian Ocean and have been recorded south and south-east of Christmas Island. The subspecies mostly occurs north of 18°S but may occur up to 1,500 km from Christmas Island at the edge of the continental shelf off WA (at 21°S). The species preys on cephalopods and fish captured by vertically plunging into water from up to 20 m and swooping along the surface of the water (TSSC 2014c).

Common Noddy

The common noddy (*Anous stolidus*; migratory) is most commonly found over the ocean and offshore of WA's north-west and central coasts and occurs on Christmas and Cocos (Keeling) Islands. The species is rarely encountered off the NT coast. The preferred habitat for the common noddy includes shoals or cays of coral or sand rocky islets and stacks with precipitous cliffs. The species mainly eats fish caught on or just below the surface of the water while flying. The common noddy forages far from shore and has been recorded at sea hundreds of kilometres from breeding islands. Although migration patterns of the species are not well known, during the non-breeding period from March to August the common noddy are known to migrate 700 km to shelf waters around the Montebello Islands (DoE 2023au; Surman et al. 2018).

Common Greenshank

The common greenshank (*Tringa nebularia*; Endangered, Migratory) is widespread in coastal regions, occurs in all types of wetlands and has the widest distribution of any shorebird in Australia (DCCEEW 2024h). The species is sparsely scattered through most of the NT (DCCEEW 2024h), with important areas in the Kakadu National Park, Milingimbi coast, and the southwest coastline of the Gulf of Carpentaria, but no sites of international significance in the NT (Birdlife Australia 2020). The common greenshank roosts around wetlands, in shallow pools and puddles, or slightly elevated on rocks, sandbanks or small muddy islets (DCCEEW 2024h). They occur in estuaries and mudflats, mangrove swamps and lagoons (DCCEEW 2024h). During feeding, the birds pick from the surface (DCCEEW 2024h) while wading in shallow water along the edge of tidal estuaries, muddy claypans, saltworks and saltpans (DCCEEW 2024h). The species arrives in Australia from August, with most leaving by March and April, but some overwintering also occurs (DCCEEW 2024h). The species may occasionally be seasonally present within the intertidal zones and shorelines within the EMBA.

Common Sandpiper

The common sandpiper (*Actitis hypoleucos*; migratory) is a shorebird found along Australian coastlines and mostly found around muddy margins or rocky shores and rarely on mudflats. The common sandpiper is typically carnivorous such as molluscs, crustaceans and insects (Higgins and Davies 1996). The common sandpiper breeds in Europe and Asia during April to August (DoE 2023ae).

Curlew Sandpiper

The curlew sandpiper (*Calidris ferruginea*; critically endangered, migratory) has a broad distribution and has been recorded along the coasts of all Australian states and territories (DoE 2023ag). In WA, curlew sandpipers are widespread around coastal and subcoastal plains from Cape Arid to south-west Kimberley, and more sparsely distributed between Carnarvon and Dampier Archipelago. Although occurring in large numbers at Port Hedland Saltworks, 80 Mile Beach, Roebuck Bay and Lake Macleod, this species is rarely recorded in the north-west Kimberley. In the NT, curlew sandpipers mostly occur around Darwin, north to Melville Island and Cobourg Peninsula, and east and south-east to Gove Peninsula, Groote Eylandt and Sir Edward Pellew Island (DoE 2023ag; DCCEEW 2023f). Although the species' preferred habitat is intertidal mudflats in sheltered coastal areas where they forage in nearshore waters or mud at the edge of wetlands, they are also widespread inland in smaller numbers (DoE 2023ag). The curlew sandpiper migrates along the East Asian-Australasian Flyway from their breeding grounds in Siberia to Australia, generally arriving in Australia around late August/early September and departing by mid-April. Some non-breeding individuals may not undertake the migration northward but stay in Australia (DoE 2023ag). The EPBC Act protected matters report states that this species or habitat may occur within the area. Based on the known distribution, preferred feeding and roosting habitats, it is considered highly unlikely that individuals will interact with the Planning Area.

Eastern Curlew

The eastern curlew (*Numenius madagascariensis*; critically endangered, migratory) is the world's largest species of shorebird (DoE 2023ah; Menkhorst et al. 2017). The species is restricted to the East Asian-Australasian Flyway, migrating annually to breeding grounds in Russia and north-eastern China before returning to Australia in August to forage, primarily in intertidal mudflats on larger prey items such as crab (DoE 2023ah; Menkhorst et al. 2017; Bamford et al. 2008). In Australia, the species has a continuous distribution from Barrow Island and Dampier Archipelago in WA through the Kimberley and along the NT, Qld, NSW coasts and the islands of Torres Strait (DCCEEW 2023e). There are two internationally important non-breeding sites in northern WA; Roebuck Bay and Eighty Mile Beach (Bamford et al. 2008).

Greater Frigatebird

The greater frigatebird (*Fregata minor*; migratory) is widespread and breeds on a number of small and remote tropical and sub-tropical islands (DCCEEW 2024k; Birdlife International 2020). Whilst the species typically nests in mangroves or bushes, it may also nest on the bare ground (Birdlife International 2020). The greater frigatebird forages both inland and along coastlines, potentially straying up to 200 km from the colony to forage during the early breeding season (Birdlife International 2018a; DCCEEW 2024k). The species' diet consists largely of fish, squid and the chicks of other bird species (Birdlife International 2020; DCCEEW 2024k). There are large breeding populations of this species in the tropical waters of the Pacific and Indian Oceans (Birdlife International 2020). Within WA, the greater frigatebird has a small breeding colony at Ashmore Reef and is found throughout the north and eastern coastal and offshore areas of Australia (Mott 2016; DCCEEW 2024k). The species also breeds on Christmas and North Keeling Islands, located outside the Planning Area (Menkhorst et al. 2017). The Planning Area overlaps a known breeding BIAs for the greater frigatebird and is included in Figure 7-26.

Fork tailed Swift

In WA, the fork tailed swift (*Apus pacificus*; migratory) are sparsely scattered records of the fork-tailed swift along the south coast, ranging from near the Eyre Bird Observatory and west to Denmark. They are widespread in coastal and subcoastal areas between Augusta and Carnarvon, including some on nearshore and offshore islands. They are scattered along the coast from south-west Pilbara to the north and east Kimberley region, near Wyndham. There are sparsely scattered inland records, especially in the Wheatbelt, from Lake Annean and Wittenoom. They are found in the north and north-west Gascoyne Region, north through much of the Pilbara Region, and the south and east Kimberley (Higgins 1999).

In the NT scattered records exist around some offshore islands, mostly south to Victoria River Downs.

Great Knot

The great knot (*Calidris tenuirostris*, Vulnerable, migratory) is a shorebird that winters in Australia primarily along the northern coastline, arriving in north-west Australia in large numbers from late August to early September, with juveniles and many males arriving in October-November; DCCEEW 2024a). The great knot

breeds in the northern hemisphere and undertakes biannual migrations along the East Asian-Australasian Flyway. This species has been recorded from the entirety of the Australian coast, with greatest numbers along the coastlines of northern WA and the NT, with scattered records inland. The great knot is common on the coasts of the Kimberley and Pilbara, from the Dampier Archipelago to the NT border, and from Darwin and Melville Island, through Arnhem Land to the southeast Gulf of Carpentaria in the NT. Great knots primarily feed on bivalve molluscs and other invertebrates such as snails, worms and crustaceans they find in the soft mud of intertidal mudflats, especially along the water's edge (DCCEEW 2024a).

Greater Sand Plover

Greater sand plovers (*Charadrius leschenaultia*; vulnerable, migratory) are shorebirds that migrate from breeding areas in Mongolia, Siberia and China to coastal areas in all Australian states. This species occurs in the greatest numbers in north-western Australia and is especially widespread between North West Cape and Roebuck Bay in WA, with scattered records between Roebuck Bay and Darwin. Greater sand plovers are often recorded in the Top End of the NT including on Groote Eylandt, and is widespread from the Torres Strait, Ashmore Reef, Cocos-Keeling and Christmas Islands (DoE 2023aj; DCCEEW 2023g). In Australia, greater sand plovers are almost entirely coastal, inhabiting littoral and estuarine habitats on sheltered muddy, sandy or shelly beaches, large intertidal mudflats, saltmarshes, estuaries, sandbanks, coral reefs, rocky islands rock platforms, tidal lagoons and coastal dunes. Greater sand plovers feed on molluscs, worms, crustaceans and insects they find in wet sand or mud on open intertidal flats of sheltered embayments, lagoons or estuaries (DoE 2023aj; DCCEEW 2023g).

Greater Crested Tern

The crested tern (*Thalasseus bergii*; migratory) is a widely distributed species recorded from almost all Australian coastlines. Adults forage up to 40 km daily to catch fish, cephalopods, crustaceans and insects (DoE 2023ar).

Grey Plover

Grey plovers (*Pluvialis squatarola*; Vulnerable; Migratory) have been recorded along the coast in all states of Australia, with small numbers regularly recorded in the NT (DCCEEW 2024g). Migrating birds arrive in northern Australia between August and October with many continuing their migration to southern regions. Plovers which have remained along the northern coastline for the non-breeding season leave between February and April (DCCEEW 2024g). Some non-breeding individuals may stay in Australia. The species usually roosts in sheltered, sandy areas including unvegetated sandbanks or sand-spits, or other sheltered environments such as estuaries or lagoons, and are often seen in small numbers on mangrove mudflats (DCCEEW 2024g). Kakadu National Park, Milingimbi coast, and the southwest coastline of the Gulf of Carpentaria have been identified as areas of importance to this species in the NT, but they do not represent sites of international significance (Birdlife Australia 2020). In Australia, grey plovers feed by pecking and probing for worms, molluscs, and crustaceans mostly in mud or soft, wet sand of sandflats, intertidal mudflats, saltmarshes, and beaches (DCCEEW 2024g). The species is likely to present at roosting sites on shorelines within the EMBA and may seasonally fly over the offshore waters.

Grey Wagtail

The grey wagtail (*Motacilla cinerea*; migratory) is widely distributed, with several populations breeding in Europe and Siberia. In Australia, the grey wagtail is widely distributed throughout Australia and several offshore islands. The grey wagtail feed on a variety of aquatic invertebrates including adult flies, mayflies, beetles, crustacea and molluscs (Birdlife International 2017).

Lesser Crested Terns

The lesser crested tern (*Thalasseus bengalensis*) is not listed as an EPBC Act listed threatened or migratory species. The lesser crested tern is a strictly coastal species usually found on beaches and estuaries. This species is known to breed on Ashmore Reef and other WA islands located outside of the Planning Area such as Adele Island, Lacepede Island and Lowendal Islands (DoE 2023aw; Nicholson 1998). A known breeding BIA for the lesser crested tern overlaps the Planning Area and is included in Figure 7-26.

Little Tern

Conventionally accepted as *Sternula albifrons* (Pallas, 1764) (vulnerable, migratory), the species was previously placed in the genus *Sterna*. There are three subpopulations that occur in Australian territory: subspecies *S. a. sinensis* comprises of two subpopulations, one of which breeds in northern Australia (hereafter referred to as the northern subpopulation), the other subpopulation breeds in north-east Asia and migrates to northern and eastern Australia during the non-breeding season; and subspecies *S. a. placens* which breeds in south-eastern Australia and also occurs in New Zealand during the non-breeding season (hereafter referred to as the south-eastern subpopulation) (DCCEEW 2025e). The taxonomic split of these two subspecies *sinensis* and *placens* is recent (Gochfeld et al. 2016) and is not universally agreed. Previously it was considered that all birds occurring in Australian territory belong to subspecies S. a. sinensis (TSSC 2002)

The northern subpopulation breeds across northern Australia from Broome to the Cape York Peninsula most of the year, and an eastern subpopulation which breeds on the eastern and south-eastern coast Australian coast. (DCCEEW 2025e). Little terns are widespread in Australia, with breeding sites widely distributed across north-western Australia. This species inhabits sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays harbours and inlets, especially those with exposed sandbanks or sand-spits. Little Terns are widespread on islands off the NT coast and forage in shallow waters of estuaries and coastal lagoons over channels often close to breeding colonies. They also forage along open coasts within 50 m of shore and less often at sea. Little terns feed on small fish, crustaceans, molluscs and insects (DCCEEW 2025e). Known breeding and resting BIAs overlap the Planning Area and are included in Figure 7-26.

Lesser Frigatebird

The lesser frigatebird (*Fregata aerial*; migratory) occurs throughout the tropical and warmer waters of northern and eastern Australia (DCCEEW 2024m), breeding on islands such as Ashmore Reef and North Keeling, as well as a number of other islands located off the north coast of WA (Menkhorst et al. 2017; Mott 2016). The lesser frigatebird feeds on prey items such as flying fish by catching their prey at or just above the ocean surface (DCCEEW 2024m). This species also occasionally feeds on squid, octopus and the chick of other bird species, and typically does not forage far from the breeding colony (DCCEEW 2024m; Birdlife International 2017a). Figure 7-26 and Table 7-16 shows the known breeding BIAs for the lesser frigatebird that overlap the Planning Area.

Lesser Sand Plover

Lesser sand plovers (*Charadrius mongolus,* Endangered, migratory) are widespread in coastal regions and have been recorded in all Australian states, with the highest numbers in Queensland and NSW. The lesser sand plover is mainly found in northern and eastern Australia, Torres Strait islands and on Christmas Island. In the NT, lesser sand plovers occur along most of the coast, with the coastline from Anson Bay to Murgenella Creek, the northern Arnhem coast, Blue Mud Bay and the Port McArthur area significant areas (DoE 2023ak; DoE 2016d). Arriving in Australia in August, lesser sand plovers move along the northern and eastern coasts until October or November, leaving the Broome-Port Hedland region in late April for their northern migration. Lesser sand plovers are usually found in coastal littoral and estuarine environments inhabiting large intertidal sandflats or mudflats in sheltered bays, estuaries and harbours and occasionally on sandy ocean beaches and coral reefs. This species feeds on insects, crustaceans, molluscs and polycheate worms in freshly exposed intertidal mudflats and sandflats in estuaries or beaches, and occasionally on coral reefs (DoE 2023ak; DoE 2016d).

Masked Booby

The masked booby (*Sula dactylatra;* migratory) is the largest and heaviest of the booby family. The masked booby ranges from the northeastern to north western coastline of Australia, including offshore islands (Marchant and Higgins 1990). In Australia, there is a breeding population on Lord Howe, NSW (Priddel et al. 2005).

Oriental Cuckoo

The oriental cuckoo (*Cuculus optatus*; migratory) is mostly found in northern and eastern Australia, inhabiting predominately forests. Several populations breed on northern Europe and Asia. The oriental cuckoo feeds mainly on insects and their larvae (Birdlife International 2021).

Oriental Plover

The oriental plover (*Charadrius veredus*; migratory) is a non-breeding visitor to Australia, where the species occurs in both coastal and inland areas, mostly in northern Australia. Most records are along the north-western coast, between Exmouth Gulf and Derby in Western Australia, and there are records at a few scattered sites elsewhere, mainly along the northern coast, such as in the Top End, the Gulf of Carpentaria and on Cape York Peninsula (DCCEEW 2025f). Eighty Mile Beach, Port Hedland Saltworks, Roebuck Bay in Western Australia and Lake Sylvester in Northern Territory are considered internationally important sites for the oriental plover (Jaensch 1994; Lane 1987; Minton et al. 2003; Watkins 1993). Oriental plovers usually forage among short grass or on hard stony bare ground (McCrie 1984), but also on mudflats or among beachcast seaweed on beaches (Bigg 1981; Close 1982).

Oriental Pratincole

The oriental pratincole (*Glareola maldivarum*; migratory) is a non-breeding visitor that arrives in northern Australia in November and December before leaving at the end of March and early April. The oriental pratincole is widespread in East Asia and most spend the non-breeding season in Australia, where 2.88 million were reported in February 2004 (Sitters et al. 2004). Oriental pratincoles prefer open habitats, such as grassland and farmland, over which they hawk for insects (Hassel and Piersma 2010). In non-breeding grounds in Australia, the Oriental Pratincole usually inhabits open plains, floodplains or short grassland (including farmland or airstrips), often with extensive bare areas (DCCEEW 2025g). They often occur near terrestrial wetlands, such as billabongs, lakes or creeks, and artificial wetlands such as reservoirs, saltworks and sewage farms, especially around the margins and the species also occurs along the coast, inhabiting beaches, mudflats and islands, or around coastal lagoons (Garstone 1978 in DCCEEW 2025).

It is not considered globally threatened (Maclean 1996) and is classified as being of least concern.

Oriental Reed-Warbler

The oriental reed-warbler (*Acrocephalus orientalis*; migratory) is distributed in northern and eastern Australia and Asia. It breeds in northern Asia and forages for insects and other invertebrates (Birdlife International 2024).

Osprey

Osprey (*Pandion haliaetus*; migratory) occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia (DCCEEW 2025h). They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. Although they exhibit a preference for coastal cliffs and elevated islands in some parts of their range but may also occur on low sandy, muddy or rocky shores and over coral cays (DCCEEW 2025h).

Pectoral Sandpiper

Pectoral sandpiper (*Calidris melanotos*; migratory) is a small–medium wader bird found throughout Australia, preferring prefers shallow fresh to saline wetlands. Pectoral sandpipers feed in grass or mud away from the water's edge, consuming insects, crustaceans and seeds (Higgins and Davies 1996).

Red-footed Booby

The red-footed booby (*Sula sula*; migratory) has an extensive distribution in tropical regions of the Indian, Pacific and Atlantic oceans. In Australia, this species is not known to travel far from breeding colonies, however juveniles emigrate to other islands. The species has not been recorded from WA or the NT coasts, but breeding occurs on Ashmore Reef. The red-footed booby forages in deep water up to 150 km from the nearest breeding island on fish, especially flying fish, and cephalopods by plunge diving to small depths (DoE 2023ap). A known breeding BIA for the red-footed booby overlaps the Planning Area and is included in Figure 7-26.

Red Knot

The red knot (*Calidris canutus*; vulnerable) is an omnivorous wading bird which uses the intertidal mudflats, sandflats and sandy beaches of sheltered coastal areas, estuaries, bays and other similar marine habitats. The red knot is present throughout coastal and offshore Australia, including Christmas and Cocos Keeling Islands. Notably, large numbers of red knots are regularly recorded in the north-west of Australia (specifically at 80 Mile Beach and Roebuck Bay) and the species is present along the Ningaloo coast and at Lake Macleod

(DCCEEW 2024n; Bamford et al. 2008). At the end of the breeding season the species returns south, arriving in northern Australia in late August to early September to take up residence, as well as settling in other areas primarily in eastern Australia and New Zealand (DCCEEW 2024n; Watkins 1993).

Red-rumped Swallow

The red-rumped swallow (*Cecropis daurica*; migratory) is a widespread Eurasian migratory bird with irregular occurrences within northern Australia. The red-rumped swallow migrates to Australia during its non-breeding season between October and April (Jackson and Kyne 2013).

Red-tailed Tropicbird

The red-tailed tropicbird (*Phaethon rubricauda;* migratory) is a seabird native to tropical parts of the Indian and Pacific Oceans. The red-tailed tropicbird is predominately a plunge diver, diving from an above-water height ranging from ~6 to 50 m and to a depth of ~4.5 m, although this may change seasonally. The species prey on mainly squid and flying fish (BirdLife International 2020).

Red-tailed Tropicbird (Indian Ocean)

The Indian Ocean red-tailed tropicbird (*Phaethon rubricauda westralis*; endangered) is a pelagic and can be found in tropical and subtropic parts of the Indian Oceans (Marchant and Higgins 1990). The subspecies has a wide range across eastern Indian Ocean when not breeding; current breeding areas occur on Christmas Island (James & McAllan 2014) Cocos (Keeling) Islands (Stokes et al. 1984); Bedwell Island and Rowley Shoals (RWA, 1986); and West, Middle and East Islands of Ashmore Reef (Clarke et al. 2011); and Rottnest Island (Mather & Greenwell 2021; Bell et al. unpublished data). The species prey on mainly squid and flying fish (BirdLife International 2020; DCCEEWc).

Roseate Tern

Roseate terns (*Sterna dougallii*; migratory) are a marine migratory bird species recorded from south-west WA to south-east Qld. In WA, roseate terns regularly occur from Mandurah to Eighty Mile Beach in the Pilbara Region, and at scattered sites north to at least the Bonaparte Archipelago in the Kimberley Region. In the NT, this species mainly occurs from Darwin to Gove Peninsula, west to North Peron Island and east to the Sir Edward Pellow Islands. Breeding mainly occurs off the WA and NT coasts during two distinctive periods either in spring-summer or autumn-winter, with April to November the peak laying periods. Roseate Tern migration varies geographically and is not well documented. This species inhabits coral reefs, rocky and sandy beaches, sand cays and offshore islands, feeding by plunge-diving for fish in the ocean (DoE 2023ao). The Planning Area overlaps a breeding BIA for the roseate tern and is included in Figure 7-26.

Ruddy Turnstone

Ruddy turnstone (*Arenaria Interpres*; vulnerable, migratory) is widespread within Australia during its non-breeding period of the year (Bamford *et al*. 2008), including from Tasmania in the south to Darwin in the north and many coastal areas in between. It is found in most coastal regions, with occasional records of inland populations (Higgins & Davies 1996). It strongly prefers rocky shores or beaches where there are large deposits of rotting seaweed (DCCEEW 2025i). The species occurs at a number of Australian sites of international importance including Eighty Mile Beach, Ashmore Reef, Roebuck Bay, Barrow Island and the Lacepede Islands in WA; and Castlereagh Bay in NT (DCCEEW 2025i).

The species mainly forages between lower supralittoral and lower littoral zones of foreshores, from strandline to wave-zone. They often forage among banks of stranded seaweed or other tide-wrack. They are also known to forage on exposed rocky platforms, coral reefs and mudflats (Higgins & Davies 1996; DCCEEW 2025i). They roost on beaches, above the tideline, among rocks, shells, beachcast seaweed or other debris (DCCEEW 2025i).

Sanderling

The sanderling (*Calidris alba*; migratory) is a wading bird species that occurs in coastal areas around Australia. In WA, they occur on most of the coast from Eyre to Derby, and also around Wyndham. They are more often recorded on the south and southwest coasts, north to around southern Shark Bay, with more sparsely scattered records further north in Gascoyne and Pilbara Regions and the Kimberley Division. IN NT, they occur

around Darwin, and possibly elsewhere on the northwest coast, also on Melville Island, shores of Van Diemen Gulf and Groote Eylandt (DCCEEW 2025j).

They arrive in Australia during September, mostly occurring in north-western Australia. They move through Roebuck Bay, Darwin and Eyre during September-November and then cross the continent to the south Australia coast.

In Australia, the species is almost always found on the coast, mostly on open sandy beaches exposed to open sea-swell, and also on exposed sandbars and spits, and shingle banks, where they forage in the wave-wash zone and amongst rotting seaweed. Sanderlings also occur on beaches that may contain wave-washed rocky outcrops. Less often the species occurs on more sheltered sandy shorelines of estuaries, inlets and harbours.

Sharp-tailed Sandpiper

The sharp-tailed sandpiper (*Calidris acuminata*; vulnerable; migratory) is a small-medium wader found throughout Australia (freshwater and saline habitats). The common sandpiper is typically omnivorous, consuming seeds, crustaceans, worms, molluscs and insects. The common sandpiper breeds in Siberia (Higgins and Davies 1996).

Streaked Shearwater

The streaked shearwater (*Calonectris leucomelas*; migratory) is a pelagic species but also found in inshore waters. The streaked shearwater breeds on the coast and islands of Japan, Russia, China, North Korea and South Korea. The streaked shearwater feeds mainly on fish and squid (BirdLife International 2018).

Wedge-tailed Shearwater

The wedge-tail shearwater (*Ardenna pacifica*; migratory) is a pelagic seabird widespread across the Indian ocean and forages across waters of the continental shelf. Wedge-tail Shearwaters breed on islands off the coast of WA, and on Cocos-Keeling Island.

Although movement patterns of this species are not well documented, populations in the northern and southern extremities of its range are known to be migratory. Populations in WA migrate north from April to May, and the species has been recorded at Ashmore Reef from August to November. Wedge-tailed shearwaters dive to a depth of two to three metres when feeding to catch deeper prey inaccessible to most other tropical seabirds (DoE 2023aq). The Planning Area overlaps a breeding BIA for the wedge-tail shearwater and is included in Figure 7-26.

Whimbrel

Whimbrel (*Numenius phaeopus*; migratory) is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. It is common and widespread from Carnarvon to the north-east Kimberley Division, WA. It has been recorded at Roebuck Bay Ramsar wetland in WA. The whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms (DCCEEW 2025k). The species generally forages on intertidal mudflats, along the muddy banks of estuaries and in coastal lagoons, either in open unvegetated areas or among mangroves. They sometimes forage on sandy beaches or among rocks. It has occasionally been sighted feeding on exposed coral or rocky reefs and rock platforms. It is known to probe holes and crevices among rubble and on reef flats, but not on reef crests (Higgins & Davies 1996; DCCEEW 2025k); they typically roost in mangroves and tall coastal trees.

White-tailed Tropicbird

White-tailed tropicbird (*Phaethon lepturus*; migratory) is a medium sized seabird. The white-tailed tropicbird usually feeds alone or in pairs (Marchant and Higgins 1990) and is less often associated with flocks of seabirds and subsurface predators (e.g. tuna) than do other tropical seabirds (DoE 2023af). A breeding BIAs for the white-tailed tropicbird overlaps the Planning Area and is included in Figure 7-26.There are three breeding populations—Rowley Shoals, North Keeling Island (outside the Planning Area) and Ashmore Reef (DoE 2023af).

Yellow Wagtail

The yellow wagtail (*Motacilla flava*; migratory) is widely distributed, with several populations breeding in Europe and Asia. In Australia, the yellow wagtail is widely distributed throughout Australia and several offshore islands. It feeds on a variety of terrestrial and aquatic invertebrates and some plant material, particularly seeds (Birdlife International 2019).

7.7.10.5 Seasonal Sensitivities of Threatened and Migratory Species

Table 7-17 lists the months that coincide with key environmental sensitivities (breeding, foraging aggregation or migration) for the EPBC Act listed threatened and/or migratory species potentially occurring within the Planning Area.

Table 7-17: Key environmental sensitivities and indicative timings for migratory fauna within the Activity Area and Planning Area (North-west Marine Region)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mammals												
Blue whale – northern migration (Exmouth, Montebello, Scott Reef)[1]												
Blue whale – southern migration (Exmouth, Montebello, Scott Reef)[2]												
Humpback whale – northern migration												
Humpback whale – southern migration												
Sharks, Rays and Other Fish												
Whale shark – foraging/aggregation near Ningaloo[3]												
Reptiles												
Green turtle[4]	N,H	N,H	H	H	H	N	N	H	H	H	H	N,H
Hawksbill turtle[4]	N,H	H						N,H	H	N,H	N,H	N,H
Olive ridley turtle[4]				N	N	N,H	N,H	H				
Flatback turtle[4]	N,H	H	H	H	H	N,H	N,H	N,H	N,H	N,H	N,H	N,H
Leatherback turtle[4]	N,H	H										N
Loggerhead turtle[4]	N,H	H	H	H	H							
Birds												
Migratory shorebirds[6]												

Key and notes

	Species likely to be present
	Peak period. Presence of animals reliable and predictable each year
N	Peak Turtle Nesting
H	Peak Turtle Hatching

1 – DSEWPaC 2012; McCauley and Jenner 2010
2 – DSEWPaC 2012; McCauley and Jenner 2010
3 – TSSC 2015a; Wilson et al. 2006
4 – CoA 2017b

7.7.10.6 EPBC Management Publications

The Commonwealth publishes management plans, recovery plans (RPs) and conservation advice (CA). These publications provide guidance on threats and management measures to prevent species decline, and support species recovery. To determine the relevance of each publication, the spatial extent of the species' presence, habitat and threats were examined, within the Planning Area to identify any applicable aspects for the impact and risk assessment (Section 9). Table 7-18 summarises relevant EPBC Act listed species with associated publications relevant to the Activity. The activities under this EP must not be inconsistent with any of these publications, including recovery and threat abatement plans.

Table 7-18: Summary of Relevant EPBC Act Management Publications

Species/ Sensitivity	EPBC Act Management Publication	Key Threats Identified in the RP/CA	Relevant Conservation Actions
All Vertebrate Fauna			
All vertebrate fauna	Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (CoA 2018)	Marine debris	No explicit conservation actions for non-fisheries related industries (Note: management actions in the plan relate largely to managing fishing waste and state and Commonwealth fisheries management through regulation)
Mammals			
Cetaceans and other marine megafauna	National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (CoA 2017a)	Vessel disturbance	No explicit relevant conservation actions
Sei whale	Approved conservation advice *Balaenoptera borealis* (sei whale) (DoE 2015c)	Noise interference	Assess and manage acoustic disturbance
		Vessel disturbance	Assess and manage physical disturbance and development activities
		Climate change	No explicit relevant conservation actions
Pygmy blue whale	Conservation management plan for the blue whale: A recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015–2025 (CoA 2015a)	Noise interference	Assess and address anthropogenic noise
		Vessel disturbance	Minimise vessel collisions
		Climate change	No explicit relevant conservation actions
		Habitat modification	No explicit relevant conservation actions
Fin whale	Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC 2015b)	Noise interference	Assess and address anthropogenic noise
		Vessel disturbance	Minimise vessel collisions
		Climate change	No explicit relevant conservation actions
Australian snubfin dolphin	Conservation advice for *Orcaella heinsohni* (Australian snubfin dolphin) (DCCEEW 2025a)	Habitat loss and degradation – climate variability and change	No explicit relevant conservation actions
		Marine pollution	No explicit relevant conservation actions
		Anthropogenic underwater noise	Vessel activities must be undertaken in accordance with the Part 8 Environment

Species/ Sensitivity	EPBC Act Management Publication	Key Threats Identified in the RP/CA	Relevant Conservation Actions
		(industrial noise, vessel noise)	Protection and Biodiversity Conservation Act Regulations and the National Whale and Dolphin Watching Guidelines (DoEE 2017).
		Vessel interaction (strike)	Vessel activities must be undertaken in accordance with the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna and the National Guidelines for Whale and Dolphin Watching.
Australian humpback dolphin	Conservation advice for *Sousa sahulensis* (Australian humpback dolphin) (DCCEEW 2025b)	Habitat loss and degradation – climate variability and change	No explicit relevant conservation actions
		Marine pollution	No explicit relevant conservation actions
		Vessel interaction (strike)	Vessel activities must be undertaken in accordance with the Part 8 Environment Protection and Biodiversity Conservation Act Regulations and the National Whale and Dolphin Watching Guidelines (DoEE 2017).
		Anthropogenic underwater noise (industrial noise, vessel noise)	Vessel activities must be undertaken in accordance with the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna and the National Guidelines for Whale and Dolphin Watching.
Reptiles			
Loggerhead turtle, green turtle, leatherback turtle, hawksbill turtle, flatback turtle, olive ridley turtle	National Light Pollution Guidelines for Wildlife (CoA 2023b)	Light pollution	Minimise light pollution
	Recovery plan for marine turtles in Australia 2017–2027 (CoA 2017b)	Light pollution	Minimise light pollution
		Chemical and terrestrial discharge (oil pollution)	Ensure that spill risk strategies and response programs include management for turtles and their habitats
		Climate change	No explicit relevant conservation actions
		Vessel disturbance	No explicit relevant conservation actions
		Marine debris	Support the implementation of the Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (CoA 2018)
		Noise interference	No explicit relevant conservation actions
Leatherback turtle	Approved Conservation Advice for *Dermochelys coriacea* (leatherback turtle) (TSSC 2008a)	Vessel disturbance	No explicit relevant conservation actions
		Climate change	No explicit relevant conservation actions

Species/ Sensitivity	EPBC Act Management Publication	Key Threats Identified in the RP/CA	Relevant Conservation Actions
Dusky sea snake	Conservation advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW 2024l)	Climate change and severe weather	
		Frequent and severe marine heatwaves (acute)	Climate change impact actions related to implementing regulatory mechanisms and international diplomacy to reduce greenhouse gas emissions, which are, therefore, not explicitly relevant conservation actions for the activity described within this EP.
		High average water temperature (persistent)	
		Severe cyclones and storms	
		Fossil fuel exploration and extraction	
		Oil Pollution	It is essential that gas and oil exploration, extraction, production and decommissioning activities are adequately and effectively regulated and enforced to avoid negative impacts to the dusky sea snake at all stages of each project. This includes the use of a precautionary approach to avoid potential threats until further information is available from targeted research. Monitoring for compliance is essential in this remote area. Ensure there is an effective strategy and adequate local resources and knowledge in place to rapidly respond to a large unintentional oil spill from gas and oil projects in the Browse Basin.
		Excessive Marine Noise	Use scientifically informed planning and regulation to avoid impacts across the known and likely distribution of the dusky sea snake.
		Pollution from heavy metals and other toxins	Use scientifically informed planning and regulation to avoid impacts across the known and likely distribution of the dusky sea snake, including eliminating the risk of other pollutants affecting the dusky sea snake and its habitat, including produced water and heavy metals.
		Sedimentation and coral smothering	No actions which relate to the activities described within this EP.
		Marine vessels	
		Constant Marine Noise	Ensure vessels are operating under minimal-noise guidelines in areas areas where the dusky sea snake is known or likely to occur.
		Small and fragmented population	
		Low genetic diversity	No explicit relevant conservation actions

Species/ Sensitivity	EPBC Act Management Publication	Key Threats Identified in the RP/CA	Relevant Conservation Actions
		Hybridisation	No explicit relevant conservation actions
Short-nosed sea snake	Approved Conservation Advice for *Aipysurus apraefrontalis* (short-nosed sea snake) (TSSC 2010a)	No additional threats identified	None applicable
Leaf-scaled sea snake	Approved Conservation Advice for *Aipysurus foliosquama* (leaf-scaled sea snake) (TSSC 2010b)	No additional threats identified	None applicable
Sharks and Rays			
Grey nurse shark	Recovery plan for the grey nurse shark (*Carcharias taurus*) (DoE 2023s)	Climate change	No explicit relevant conservation actions
White shark	Recovery plan for the white shark (*Carcharodon carcharias*) (DSEWPaC 2013)	No additional threats identified (ex. marine debris)	No explicit relevant conservation actions
		Climate change	
Northern river shark	Approved Conservation Advice for *Glyphis garricki* (northern river shark) (TSSC 2014a)	Habitat degradation/modification	Implement measures to reduce adverse impacts of habitat degradation and/or modification
	Sawfish and river shark multispecies recovery plan (CoA 2015b)		Identify risks to important sawfish and river shark habitat and measures need to reduce those risks
Green sawfish	Approved Conservation Advice for green sawfish (TSSC 2008b)	Habitat degradation/modification	No explicit relevant conservation actions
	Sawfish and river shark multispecies recovery plan (CoA 2015b)		Identify risks to important sawfish and river shark habitat and measures need to reduce those risks
Whale shark	Approved Conservation Advice on *Rhincodon typus* (whale shark) (DoE 2015e)	Vessel disturbance	Minimise offshore developments and transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations and along the northward migration route that follows the northern WA coastline along the 200 m isobath
		Habitat disruption from mineral exploration, production and transportation	Minimise offshore developments and transit time for large vessels
		Marine debris	No explicit relevant conservation actions
		Climate change	
Dwarf sawfish	Approved Conservation Advice for P*ristis clavata*		No explicit relevant conservation actions

Species/ Sensitivity	EPBC Act Management Publication	Key Threats Identified in the RP/CA	Relevant Conservation Actions
	(dwarf sawfish) (TSSC 2009)	Habitat degradation/modification	
	Sawfish and river shark multispecies recovery plan (CoA 2015b)		Identify risks to important sawfish and river shark habitat and measures need to reduce those risks
Freshwater sawfish	Conservation Advice for *Pristis pristis* (largetooth sawfish) (DCCEEW 2025l)	Habitat degradation/modification	No explicit relevant conservation actions
	Sawfish and river shark multispecies recovery plan (CoA 2015b)		Identify risks to important sawfish and river shark habitat and measures need to reduce those risks
Speartooth shark	Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (CoA 2014b)	Habitat degradation/modification	Implement measures to reduce adverse impacts of habitat degradation and/or modification.
		Marine debris	Partner with marine debris organisations to support initiatives that reduce marine debris likely to impact on speartooth sharks.
	Sawfish and river shark multispecies recovery plan (CoA 2015b)	Habitat degradation/modification	Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks
Birds			
All seabirds and shorebirds	National Light Pollution Guidelines for Wildlife (CoA 2023b)	Light pollution	Implement best practice light design principles and provide a suite of lighting design/lighting controls to mitigate the effect of light for projects relevant to seabirds
Migratory shorebirds[8]	Wildlife conservation plan for migratory shorebirds (DoE 2015a)	Habitat degradation/modification	Ensure all areas important to migratory shorebirds in Australia continue to be considered in development assessment processes
		Climate Change	No explicit relevant conservation actions.
Seabirds[9]	Wildlife conservation plan for seabirds (CoA 2020)	Anthropogenic disturbance	Identify, protect, and manage seabirds and their habitats in Australia
		Pollution (marine debris, light, acute, chronic)	No explicit relevant conservation actions.
		Climate Change	No explicit relevant conservation actions.
Abbott's booby		Climate Change	No explicit relevant conservation actions.

[8] Includes Asian dowitcher, bar-tailed godwit, black-tailed godwit, common greenshank, common sandpiper, fork-tailed swift, great knot, greater sand plover, grey plover, lesser sand plover, oriental plover, oriental pratincole, pectoral sandpiper, red knot, ruddy turnstone, sanderling, sharp-tailed sandpiper, whimbrel, and yellow wagtail.
[9] Includes bridled tern, brown booby, caspian tern, common noddy, great frigatebird, greater crested tern, lesser frigatebird, little tern, masked booby, red-footed booby, red-tailed tropicbird, roseate tern, streaked shearwater, wedge-tailed shearwater, osprey, and white-tailed tropicbird.

Species/ Sensitivity	EPBC Act Management Publication	Key Threats Identified in the RP/CA	Relevant Conservation Actions
	Conservation advice for Abbott's booby – *Papasula abbotti* (TSSC 2020b)	Marine debris – plastics	
Asian dowitcher	Conservation advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW 2024e)	Pollution Climate Change	No explicit relevant conservation actions.
Australian lesser noddy	Conservation advice A*nous tenuirostris melanops* (Australian lesser noddy) (TSSC 2015c)	Habitat degradation/modification Pollution/contamination	No explicit relevant conservation actions.
Australian painted snipe	Approved conservation advice on R*ostratula australis* (Australian painted snipe) (TSSC 2013)	Habitat degradation/modification	No explicit relevant conservation actions
	National Recovery Plan for the Australian painted snipe (*Rostratula australis*) (DCCEEW 2022a)	Climate Change	No explicit relevant conservation actions
Bar-tailed godwit (northern Siberian)	Approved conservation advice for *Limosa lapponica menzbieri* (yakutian bar-tailed godwit) (DCCEEW 2024d)	Habitat degradation/modification Climate Change	No explicit relevant conservation actions
Bar-tailed godwit (western Alaskan)	Conservation advice *Limosa lapponica baueri* (Alaskan bar-tailed godwit) (DCCEEW 2024c)	Habitat degradation/modification Climate Change	No explicit relevant conservation actions
Christmas Island white-tailed tropicbird	Conservation advice P*haethon lepturus fulvus* (white-tailed tropicbird-Christmas Island) (TSSC 2014c)	Marine debris – plastics	No explicit relevant conservation actions
		Pollution/contamination (oil spills)	No explicit relevant conservation actions
Curlew sandpiper	Conservation Advice C*alidris ferruginea* curlew sandpiper (DCCEEW 2023f)	Pollution/contamination Climate Change	No explicit relevant conservation actions
Eastern curlew	Conservation Advice *Numenius madagascariensis* eastern curlew (DCCEEW 2023e)	Pollution/contamination Climate Change	No explicit relevant conservation actions
Greater sand plover	Conservation advice for *Charadrius leschenaultii*	Habitat degradation/modification Climate Change	No explicit relevant conservation actions

Species/ Sensitivity	EPBC Act Management Publication	Key Threats Identified in the RP/CA	Relevant Conservation Actions
	(greater sand plover) (DCCEEW 2023g)		
Red knot, knot	Approved Conservation Advice for *Calidris canutus* (red knot) (DCCEEW 2024n)	Pollution/contamination Climate Change	No explicit relevant conservation actions
Red-tailed tropicbird	Conservation advice for *Phaethon rubricauda westralis* (indian ocean red-tailed tropicbird) (DCCEEW 2023h)	Climate Change	No explicit relevant conservation actions
Sharp-tailed sandpiper	Conservation advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW 2024i)	Pollution Climate Change	No explicit relevant conservation actions
Brown booby	Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (CoA 2018)	Marine debris	No explicit relevant conservation actions
Ruddy turnstone	Conservation advice for *Arenaria interpres* (ruddy turnstone) (DCCEEW 2024f)	Habitat loss, fragmentation and degradation Climate change Pollution	No explicit relevant conservation actions
Great knot	Conservation advice for *Calidris tenuirostris* (great knot) (DCCEEW 2024a)	Habitat loss, fragmentation and degradation Climate change Pollution	No explicit relevant conservation actions
Grey plover	Conservation advice for *Pluvialis squatarola* (grey plover) (DCCEEW 2024)	Habitat loss, fragmentation and degradation Climate change Pollution	No explicit relevant conservation actions
Common greenshank	Conservation advice for *Tringa nebularia* (common greenshank) (DCCEEW 2024g)	Habitat loss, fragmentation and degradation Climate change Pollution	No explicit relevant conservation actions
Lesser sand plover	Conservation Advice *Charadrius*	Habitat loss and degradation	No explicit relevant conservation actions

Species/ Sensitivity	EPBC Act Management Publication	Key Threats Identified in the RP/CA	Relevant Conservation Actions
	mongolus (Lesser sand plover) (DoE 2016d)	Pollution	
		Disturbance	
		Climate change	
Little tern	Conservation advice for *Sternula albifrons* (little tern) (DCCEEW 2025)	Anthropogenic disturbance	No explicit relevant conservation actions
		Habitat loss and degradation	
		Climate change	
Black-tailed godwit	Conservation advice for *Limosa limosa* (black-tailed godwit) (DCCEEW 2024b)	Habitat loss, fragmentation and degradation	No explicit relevant conservation actions
		Climate change	
		Pollution	
Christmas Island frigatebird	Conservation advice for the Christmas Island frigatebird – *Fregata andrewsi* (DAWE 2020b)	Marine debris - plastics	No explicit relevant conservation actions
Wedge-tailed shearwater	Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (CoA 2018)	Marine debris	No explicit relevant conservation actions

7.8 Socio-Economic Features, Values and Sensitivities

7.8.1 People and Communities

People residing in these coastal areas of the northern region of Australia tend to concentrate in a relatively small number of remote population centres, often separated by large expanses of pastoral and/or undeveloped land. Figure 7-27 shows and Table 7-19 summarises the main coastal towns and communities within the north-western region of Australia. Sections 7.8.1 to 7.8.9 describes the socioeconomic features and the associated values and sensitivities within or proximal to the Planning Area. Sections 7.9 and 7.10 detail the heritage and cultural features and values within or proximal to the Planning Area.

Table 7-19: Overview of Key Population Centres Adjacent

Community	Population			Employment	
	Size	Avg/Median Age	% Aboriginal	Most People Employed	% Fishing, Forestry, Agriculture
Karratha	22,199[10]	33[11]	13.3[11]	Mining[10]	0.2[11]

[10] Karratha region (Pilbara Development Commission [PDC] 2023)
[11] Pilbara region (PDC 2023)

Community	Population			Employment	
	Size	Avg/Median Age	% Aboriginal	Most People Employed	% Fishing, Forestry, Agriculture
Broome	16,959[12]	33[13]	32.3[12]	Health Care and Social Assistance[12]	3.0[12]
Derby	7,075[14]	33[13]	70.4[13]	Education and Training[14]	5.5[13]
Darwin	140,000[15]	33[15]	8.7[15]	Government and Community Services[16]	1.1[16]

[12] Broome region (Kimberley Development Commission [KDC] 2023)
[13] Kimberley region (KDC 2023)
[14] Derby-West Kimberley (KDC 2023)
[15] ABS 2022
[16] NT Government 2023c

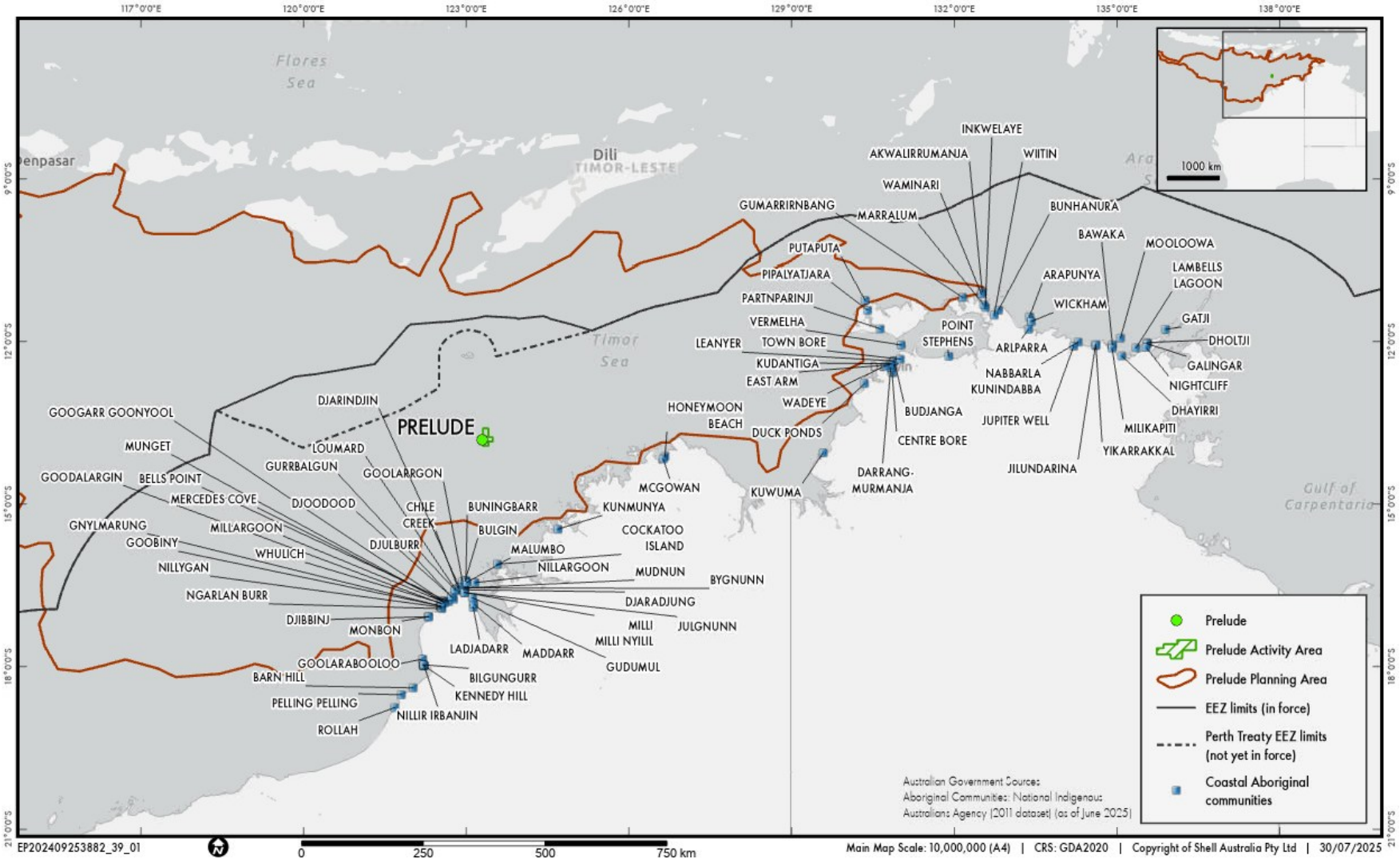


Figure 7-27: Coastal Population Centres and Communities

7.8.2 Fishing Industry

The NWMR supports Commonwealth and WA–managed commercial fisheries that target various shark, demersal and pelagic finfish, molluscs, oyster pearls and crustacean species of commercial importance. The commercial fisheries within or proximal to the Activity and Planning Areas are shown in Figure 7-28 to Figure 7-33.

Commercial fishing within the Planning Area is an important contributor to regional income and employment in the coastal towns of north-western Australia.

Commonwealth fisheries are managed by the AFMA under the *Fisheries Management Act 1991* (Cth). Commonwealth fisheries operate in Commonwealth waters within the 200 nm Australian Fishing Zone and in some cases, by agreement with a State or Territory, to the low water mark. The Commonwealth–managed commercial fisheries that occur within the Planning Area are shown in Figure 7-28. Table 7-20 summarises the current status of the Commonwealth–managed fishery, based on information in the Fishery Status Reports 2024 (DAFF 2024).

WA–managed fisheries are managed by DPIRD through a range of regulatory arrangements under the *Fish Resources Management Act 1994* (WA). The WA–managed commercial fisheries that occur within the Planning Area are shown in Figure 7-29 to Figure 7-32. Table 7-20 summarises the current status of the WA–managed fishery, based on information in the WA State of the Fisheries 2023–24 (Newman et al. 2024).

Commercial fisheries in the NT are managed by the Fisheries Division, Department of Industry, Tourism and Trade (NT Fisheries). The permitted fishing zones for each of the NT managed commercial fisheries that occur in the Planning Area are shown on Figure 7-33, with a summary of current status in Table 7-20.

Section 5 describes the consultation undertaken with AFMA, DPIRD and appropriate fishery associations and licence holders and has been used to supplement the information in the table where relevant. Table 7-20 lists and assesses the potential for interaction—informed through consultation—between the commercial fisheries and the activity.

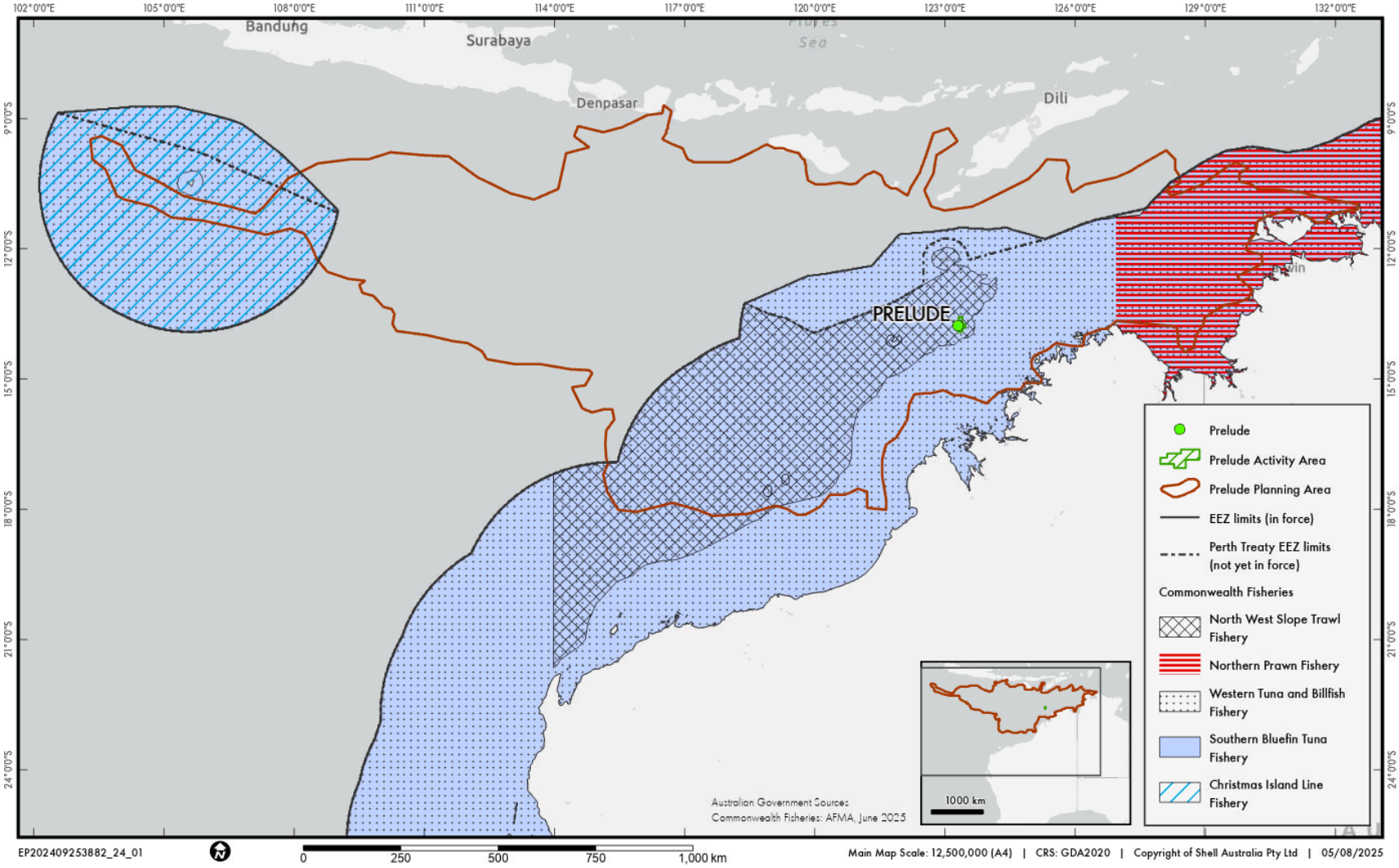


Figure 7-28: Commonwealth-Managed Fisheries Management Areas within the Planning Area

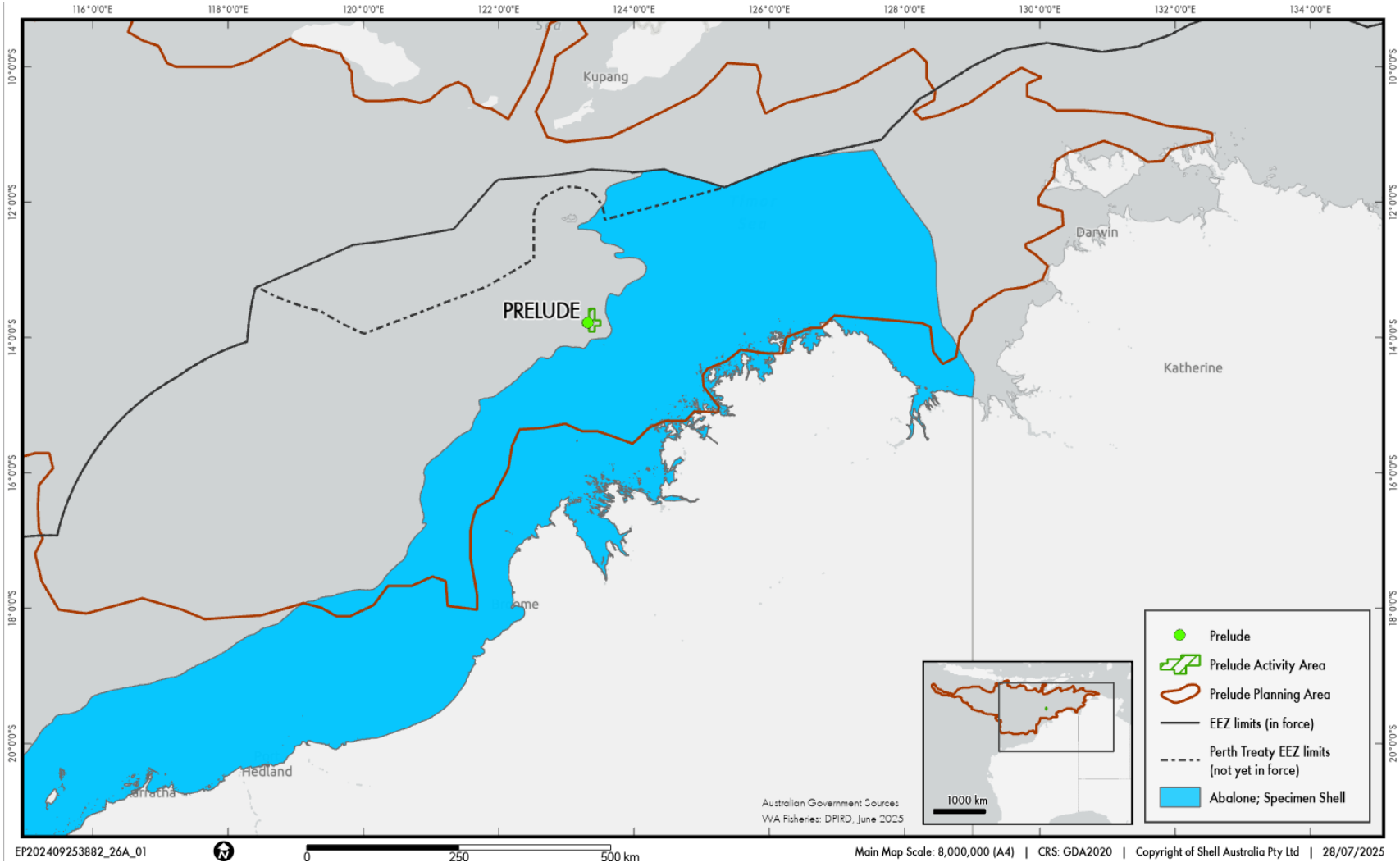


Figure 7-29: WA-Managed Fisheries Management Areas within the Planning Area (1)

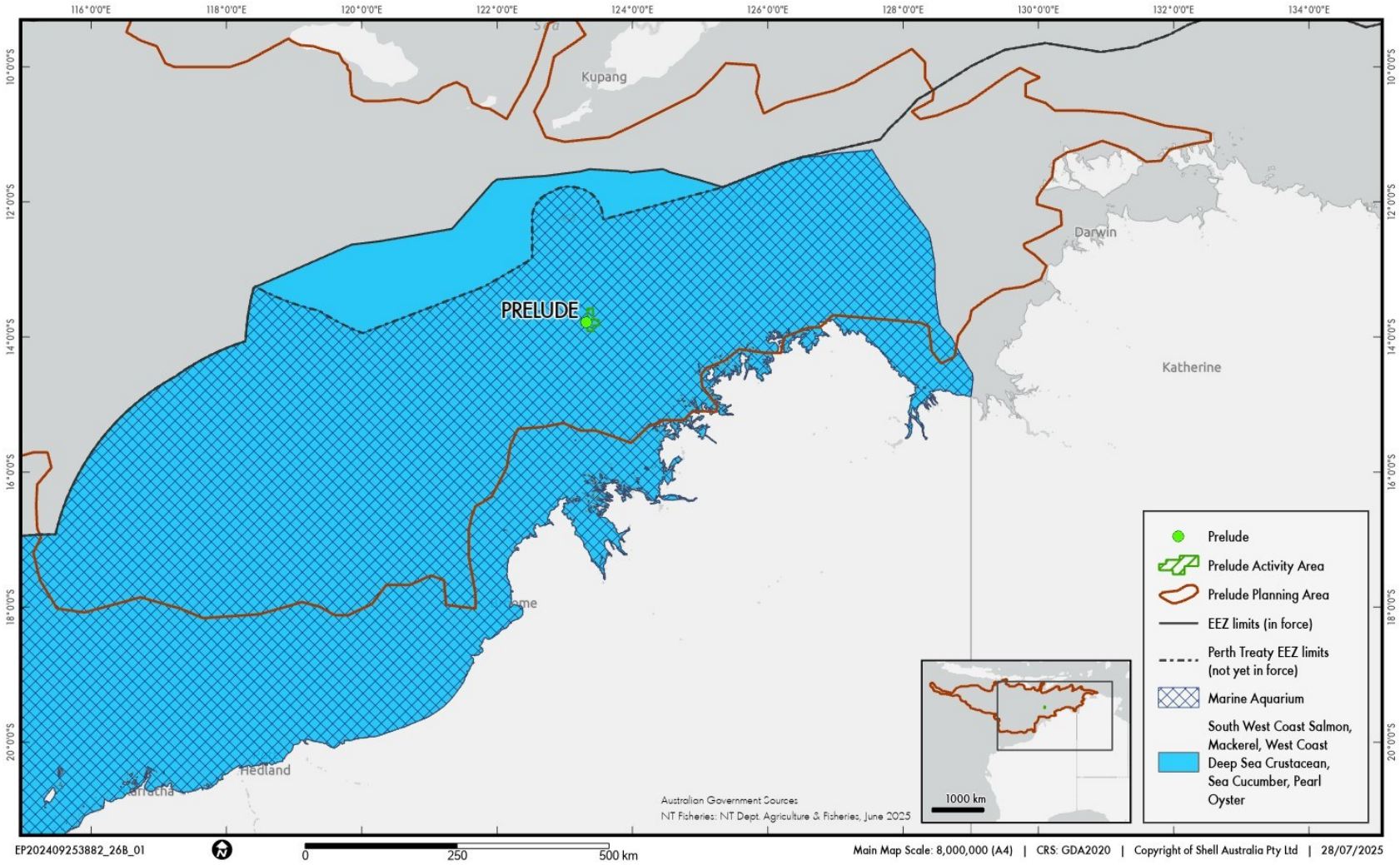


Figure 7-30: WA-Managed Fisheries Management Areas within the Planning Area (2)

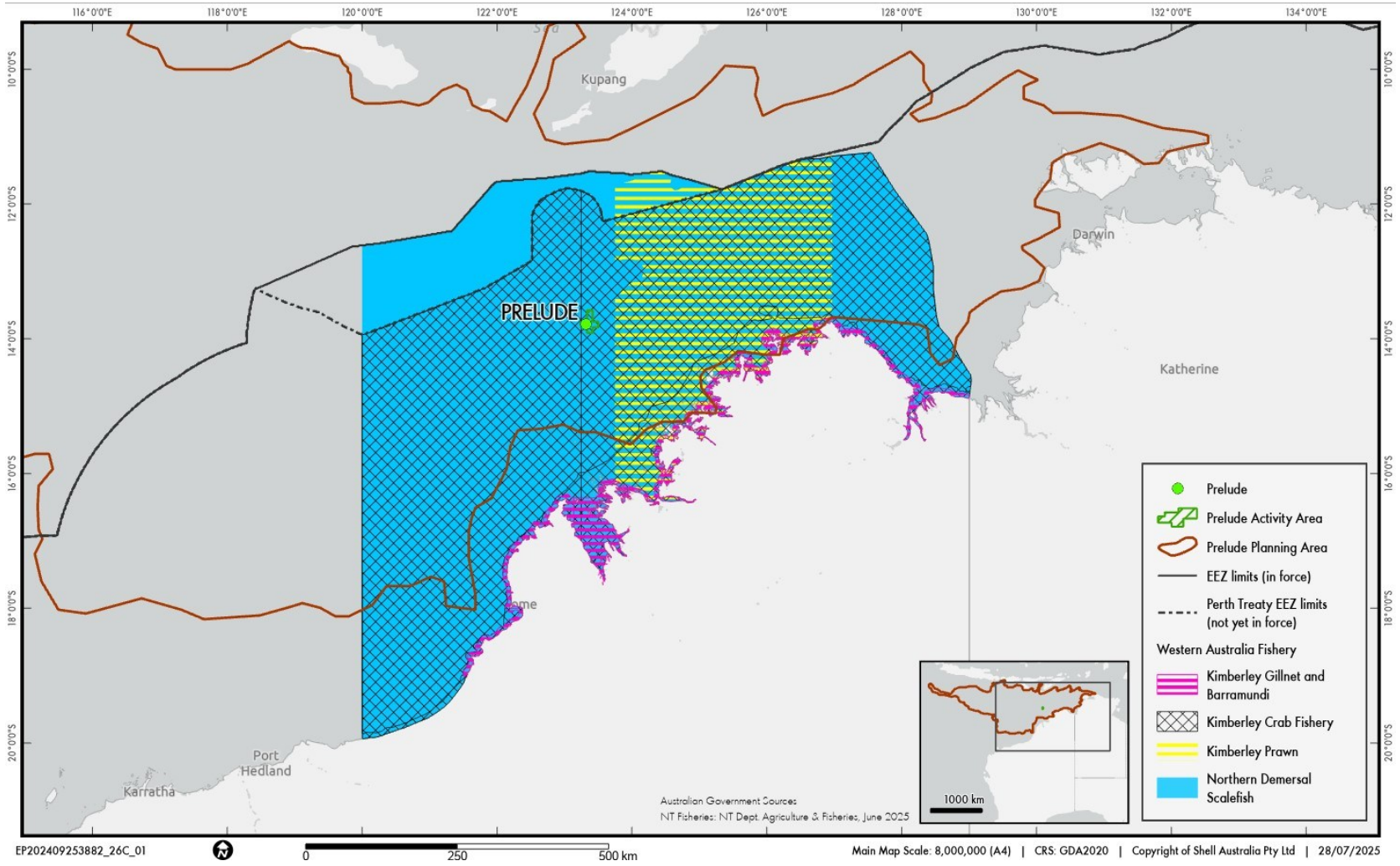


Figure 7-31: WA-Managed Fisheries Management Areas within the Planning Area (3)

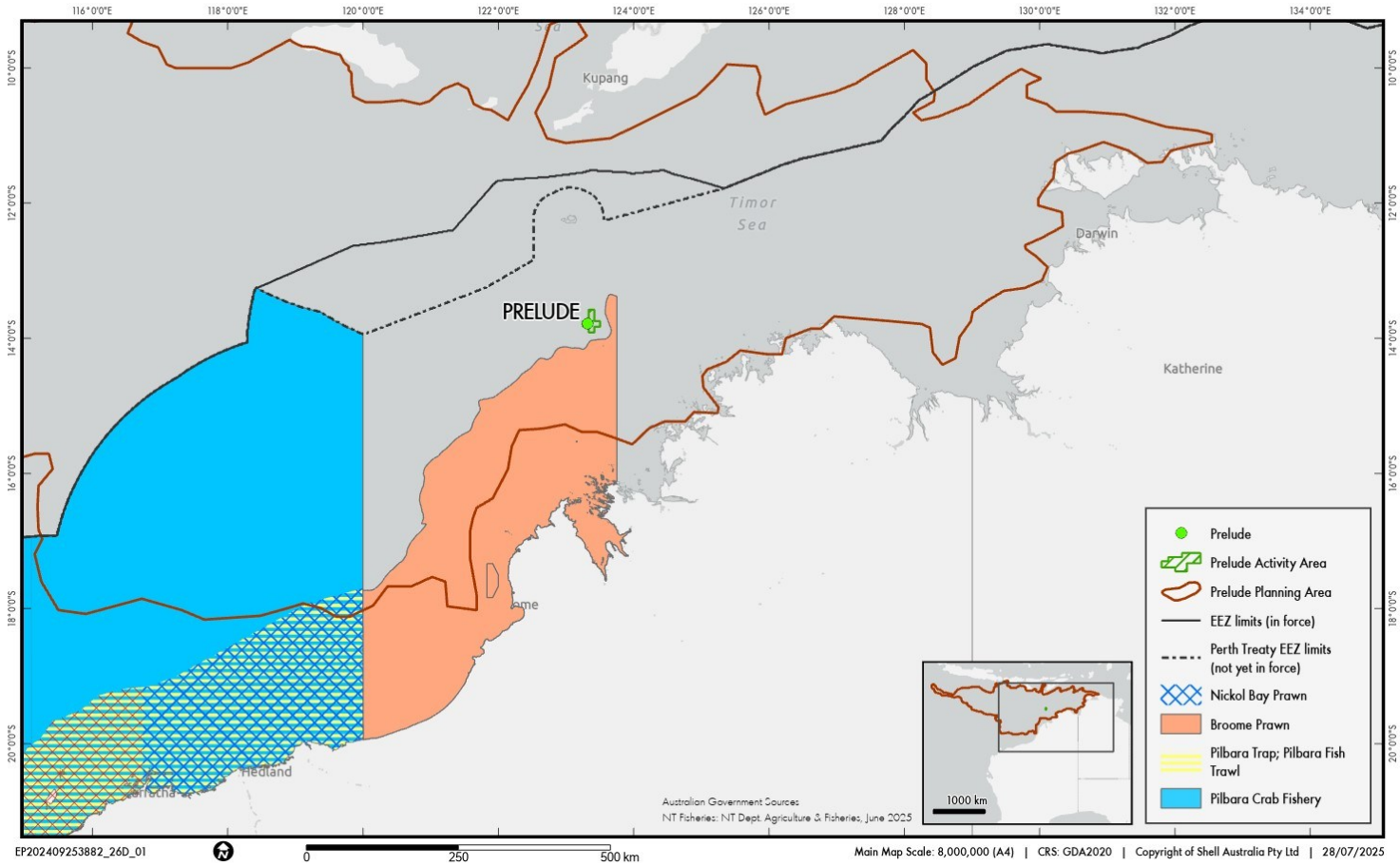


Figure 7-32: WA-Managed Fisheries Management Areas within the Planning Area (4)[17]

[17] As of 28th May 2025 t*he Kimberley Prawn Managed Fishery, Nickol Bay Prawn Managed Fishery, Broome Prawn Managed Fishery and the Onslow Prawn Managed Fishery are now collectedly referred to and managed as the North Coast Prawn Managed Fishery (NCPMF). The figures still indicate the locations of the previous titled fisheries as data in Table 1-19 describes recent catch effort.*

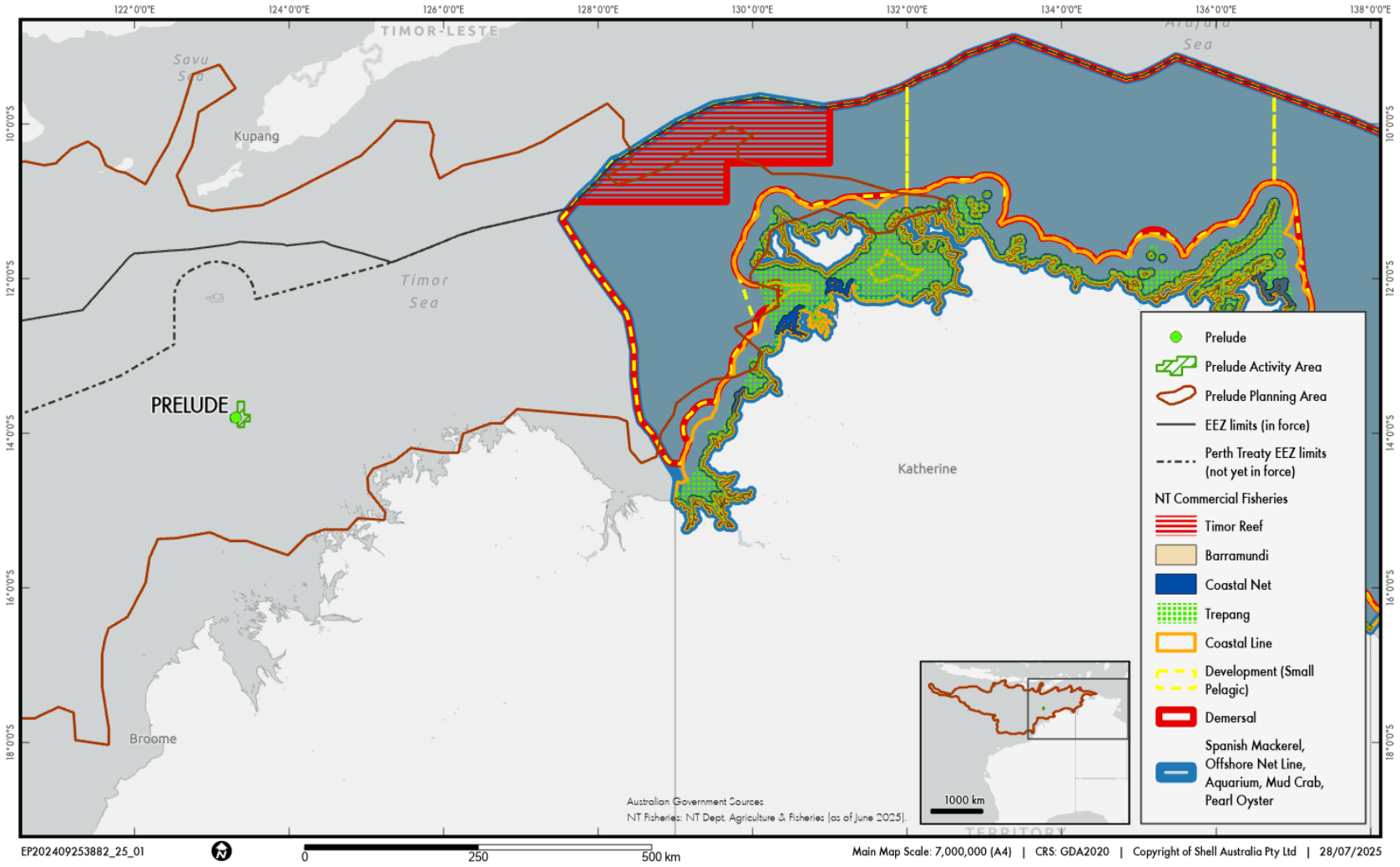


Figure 7-33: NT- Managed Fisheries Management Areas within the Planning Area

Table 7-20: Fishing Industry within the Planning Area

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
Commonwealth- Managed Fisheries				
Australian Northern Prawn Fishery	×	✓	The fishery extends from the NT high tide mark out to 200 nm. Target species include a number of tropical prawn species including white banana prawn, brown tiger prawn, and grooved tiger prawn, which comprise 80% of catch. Otter trawl gear is used. Total landed catch in 2023 was 8,517 t, comprising 8421 t of prawns and 96 t of byproduct species (predominantly scallops, cuttlefish, squid, bugs and scampi). Fifty-two permits were all used with 53 licensed vessels active in this season (DAFF 2024). Notably, seasonal fishing effort fluctuates naturally with variability in banana prawn availability. A substantial portion of fishing effort occurs within inshore coastal areas of the Gulf of Carpentaria (outside the Planning Area). The Northern Prawn Fishery management area is located approximately 433 km from the Activity Area.	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area.
Christmas Island Line Fishery	×	✓	The fishery operates within the 0-12nm zone around Christmas Island and is small, comprising only a few licensed operators, with only two of those licenses reportedly being active in historical years (Hourston 2010). Only a few species are targeted with the most common being the wahoo (*Acanthocybium solandri*) and lesser contributions being made by yellowfin tuna.	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
Cocos (Keeling) Islands Marine Aquarium	×	×	The fishery targets various fish species, including those that are popular in the marine aquarium trade, typically limited species are targeted (angelfish) but the fishing effort is very small (<800 species/year in 1993-2007 (Hourston 2010). The fishery is typically diver -based.	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area. This fishery is not shown in Figure 2-1 as there is no available data for the area.
North-West Slope Trawl Fishery	✓	✓	The North West Slope Trawl Fishery extends from 114°E to 125°E, from the 200 m isobath to the outer limit of the Australian exclusive economic zone (EEZ). Target species is scampi, including Australian scampi, velvet scampi and Boschma's scampi. Total catch in 2022–2023 was 85.4 t with three active vessels using primarily demersal trawl methods (DAFF 2024).	The fished area overlaps the Activity Area; therefore there is potential for interaction with the fishery.
Southern Bluefin Tuna Fishery	✓	✓	Fishery management area includes all Australian waters, out to 200 nm from the coast. No current effort in north-western Australia, fishing activity is concentrated in the Great Australian Bight (DAFF 2024).	Shell considers there is no potential for interaction with this fishery within the Activity Area.
Western Tuna and Billfish Fishery	✓	✓	The fishery management area is within the Australian EEZ and the high seas of the Indian Ocean. Key species in the fishery are swordfish, yellowfin tuna and bigeye tuna with striped marlin being a minor component of the catch. Main method is pelagic longline with some minor-line fishing. Most of the active The total catch was 196 t in the 2023 season with five active vessels (DAFF 2024).	Shell considers there is no potential for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
WA-Managed Fisheries				
Abalone Managed Fishery Licence	×	✓	No commercial fishing for abalone north of Moore River (Area 8 of the managed fishery) has occurred since 2011–2012 (Strain et al. 2023).	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area.
Kimberley Crab Managed Fishery	✓	✓	The Kimberley Crab Fishery operates off the north-west coast of WA in WA waters. Fishing effort is concentrated in nearshore waters and targets brown mud crab species between April and September (Johnson et al. 2023). The total catch declined from 2.38 t in 2022 to 0.45 t in 2023 with trap fishing undertaken in York Sound, Admiralty Gulf, and Cambridge Gulf mostly between April and May (Newman et al. 2024).	Interaction with this fishery is highly unlikely, given the very low fishing effort concentrated in nearshore waters.
Kimberley Gillnet and Barramundi Managed Fishery	×	✓	The Kimberley Gillnet and Barramundi Fishery operates from the Western Australian/Northern Territory border to the northern end of Eighty Mile Beach in the nearshore and estuarine zones. The managed fishery boundary extends approximately 3 nm from the shoreline. The fishery targets barramundi (*Lates calcarifer*), blue threadfin *(Polydactylus macrochir*) and king threadfin (*Eleutheronema tetradactylum*) (Newman et al. 2024). The main areas of operation for the commercial fishery are the river systems and tidal creek systems of the Cambridge Gulf (including Ord River), the Ria coast of the northern Kimberley (six small river systems), and King Sound.	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
			The extent of the fishery is located approximately 213 km to the east (near to the shoreline) of the Activity Area.	
Mackerel Managed Fishery	✓	✓	The Mackerel Fishery fishing effort is typically concentrated in the North Coast Bioregion, which encompasses the Pilbara and Kimberley coastline (Lewis and Rynvis 2023). Dominant fishing method is trolling, also with jigging methods also used to catch grey mackerel in some areas (Mackie et al. 2010). Catch effort in the 2023–2024 was 159 t in the Kimberley region with 5 active vessels (Newman et al. 2024).	Shell considers there to be limited potential for interaction with this fishery within the Activity Area.
Marine Aquarium Fish Managed Fishery	✓	✓	The marine aquarium fish fishery encompasses all WA State waters between the Northern Territory border and South Australian border. The fishery is typically diver -based and more active in waters south of Broome with higher levels of effort around the Capes region, Perth, Geraldton, Exmouth, Dampier, and Broome. There is also recent effort in the waters from Broome northwards to the NT border. The fishery has the capacity to target 1500 marine aquarium fish species (Newman et al. 2024). Catch effort in the 2023–2024 was 20,604 individuals with 11 out of 12 licences active (Newman et al. 2024). The hermit crab fishery currently permitted to fish WA waters north of, and including, Exmouth Gulf (Newman et al. 2024). The total catch in the fishery in 2023 cannot be reported due to confidentiality	Given the nature of this fishery, effort is expected to be largely restricted to coastal waters <30 m deep. Therefore, no fishing effort occurs within or near the Activity Area, and there is no potential for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
			provisions (less than three licences operated in the fishery in 2023).	
North Coast Prawn Managed Fisheries (Formerly Broome Prawn, Kimberley Prawn and Onslow and Nickol Bay Prawn Managed Fishery)	×	✓	There is no data on the fishery as a combined total as it was only declared in June 2025 and combines several other prawn managed fisheries. Therefore, a summary of the catch data from the fisheries that have been combined to make this fishery is summarised below: The Broome Prawn managed fishery primarily targeted western king prawns. Negligible fishing effort occurred, with only two boats undertaking trial fishing activities in 2023. Catches were deemed to be too low to undertake further fishing activity (Newman et al. 2024). The Kimberley Prawn managed fishery primarily targeted banana prawns with a total catch of ~107.9 t in 2023–2024 (Newman et al. 2024). There are two fishing periods for the season (April to mid-June; August to end of November). The Nickol Bay Fishery targeted banana prawns typically using otter trawls. In 2022, 3 boats fished the fishery with a total effort of 62 boat days and total commercial catch of 42 tonnes (Butler et al. 2024).	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area.
Northern Demersal Scalefish Managed Fishery (NDSMF)	✓	✓	The fishery includes all waters of the Indian Ocean and Timor Sea off the Kimberley coast of WA that are east of 120°00.079′ and north of 19°59.917′. There are some restricted areas within the fishery. The fishery is divided into two fishing areas:	Shell considers that there is potential for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
			• Area 1 – inshore • Area 2 – offshore. • Area 2 is further divided into Zone A, B and C. Offshore fishing method uses traps. Fishing effort for 2023–2024 was 1,450 t. Seven vessels fished in the 2020 fishing season (Newman et al. 2024), further consultation with Northern Demersal Scalefish identified 11 licenses across 6 vessels	
Pearl Oyster Fishery	✓	✓	This fishery targets only the silver lipped pearl oyster (Pinctada maxima) and operates from Exmouth to the NT border. It is a quota-based dive fishery, operating in shallow coastal waters along the north coast bioregion (Newman et al. 2024). The fishery is separated into four management zones; the Prelude FLNG facility lies within management zone 3. Dive based fishery with oysters collected individually as divers are towed behind the fishing vessel, using surface supplied air (Fletcher et al. 2006). Catch effort for 2023–2024 in zone 2/3 was 923,140 oysters and five vessels were active (Newman et al. 2024).	The Activity Area overlaps within management zone 3, but it is much deeper than safe diving depths in which pearl oyster fishing occurs. Most pearl fishing occurs in inner continental shelf waters (<30 m deep) along the Kimberley and Pilbara coastlines. This was confirmed by WAFIC during consultation. Shell considers that there is no potential for interaction with the fishery within the Activity Area.
Pilbara Crab Managed Fishery	×	✓	This fishery targets blue swimmer and mud crabs using commercial crab pots. The majority of the commercially fished stocks are concentrated in the coastal embayments and estuaries between Geographe Bay in the southwest and Nickol Bay in the north. Crabbing activity along the Pilbara coast is centred largely on the inshore waters from Onslow through to Port Hedland, with most commercial and	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
			recreational activity occurring in and around Nickol Bay. Catch effort for 2023-2024 was ~24t for both species and 2 vessels were active (Newman et al. 2024).	
Pilbara Fish Trawl Managed Fishery	×	✓	The Pilbara Trawl Fishery is a multi-species fishery that lands around 60 scalefish species. It operates in waters of the Pilbara region within the North Coast Bioregion of WA, utilising major ports of Port Hedland, Port Walcott (Point Samson) and Port of Dampier. The 2022-23 fishing season landed 1784 tonnes (DCCEEW 2024; Newman et.al. 2024) Trawlers are permitted to tow one net with two otter boards. Net mesh size must be a minimum of 100 mm, with a headrope length not exceeding 36.58 m, and with the overall trawl gear (including sweeps, bridles, and headropes) not exceeding 274.32 m in length. Fishing typically occurs in depths of 50 to 100 m (DCCEEW 2024; Newman et.al. 2024)	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area.
Pilbara Trap Managed Fishery	×	✓	This fishery operates in the waters of the Pilbara between North West Cape and 80 Mile Beach, north of latitude 21°44' S and between longitudes 114°9.6' E and 120°.00' E. This entire region, with water depths of between 30 and ~200 m, is open to trap fishing throughout the year, apart from Area 3 which has been closed to trapping since 1998. The fishery area extends into Commonwealth waters and targets the tropical demersal scalefish suite in the Pilbara and Kimberley, particularly the high-value snappers, cods, and emperors (Newman et al. 2024)	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
			573 tonnes were caught in caught in the 2023-2024 fishing period as part of the Northern DermersalDemersal Scalefish (CoA 2023).	
South West Coast Salmon Fishery	✓	✓	The South West Coast Salmon Managed Fishery operates on various beaches south of the metropolitan area and includes all Western Australian waters north of Cape Beaufort except Geographe Bay. No fishing takes place north of the Perth metropolitan area (well beyond the Planning Area), despite the managed fishery boundary extending to Cape Beaufort (Western Australia/Northern Territory border).	Fishing effort is concentrated in the south-west coast of WA; therefore, there is no potential for interaction with this fishery within the Activity Area. This was confirmed with WAFIC during consultation.
Specimen Shell Managed Fishery	×	✓	Fishery encompasses the entire WA coastline between the high-water mark and the 200 m isobath, with concentration of effort in areas adjacent to Broome, Exmouth, Shark Bay, Geraldton, Perth, Mandurah, the Capes area, Albany and Esperance. Hand based collection (diving, wading and ROVs) (Newman et al. 2024) Of the 30 licences in the fishery, 18 vessels were active with a total catch in 2023–2024 was 5,807 shells (Newman et al. 2024).	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area.
The Western Australia Sea Cucumber Fishery	×	✓	The Western Australian Sea Cucumber Fishery is a commercial only fishery, with animals caught principally by diving, and a smaller amount by wading. Fishing occurs mostly in the northern half of the State from Exmouth Gulf to the Northern Territory border. In 2023, Shark Bay was fished for the fourth consecutive year. Total catch in 2023 was ~126 t and	The fishery management area does not overlap with the Activity Area; therefore, Shell considers there is no potential for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
			3 commercial vessels were active (Newman et al. 2024).	
West Coast Deep Sea Crustacean Fishery	✓	✓	The fishery operates off the WA coast from 34°2′S to the NT border, from the 150 m isobath out to the Australian EEZ. Fishery uses baited pots operated in a long-line formation in shelf edge waters (>150 m) of the West Coast and Gascoyne Bioregions (Newman et al. 2024). Most catch is in waters 500–800 m deep (WAFIC 2025) and landed primarily in ports between Carnarvon and Fremantle. Catch effort for the 2023–2024 season totalled 123.1 t of crystal crab, 1.7 t of champagne crab and 0.14 t of giant crab with three active vessels (Newman et al. 2024)	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.
NT Managed Fisheries				
A12 - NT Aquarium Fishery	×	✓	The Northern Territory Aquarium Fishery targets a range of marine, estuarine and freshwater species for the aquarium trade, including finfish (e.g. freshwater rainbowfish), invertebrates (e.g. hermit crabs), plants, coral rubble and live rock (substrates covered in encrusting organisms) (NT Government 2019). This fishery operates within tidal and non-tidal waters of the Northern Territory out to the AFZ boundary. Fishing is typically either from boat or shore by diving, nets, freshwater pots and hand collection. These methods restrict fishing activity in shallow coastal, estuarine and riverine waters. There is a limit on the number of licenses issued (NT Government 2025).	The managed fishery area extends to the edge of the Australian fishing zone (200 NM from the coast) and is partially overlapped by the Planning Area. Given activity in the fishery is restricted to coastal waters, the operation of the Prelude facility is unlikely to impact upon the fishery. Shell considers that it is unlikely for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
A5 – NT Offshore Net and Line Fishery	×	✓	The Offshore Net and Line Fishery covers an area of over 542,000 km2 and extends from the NT low water mark to the boundary of the Australian fishing zone (NT Government 2019). The fishery permits both pelagic and demersal long lines or pelagic nets and is allowed to take any cartilaginous fish or any bony fish taken while targeting cartilaginous fish using approved methods. The key species taken are typically blacktip sharks, spottail sharks and grey mackerel (NT Government 2019). The majority of the fishing effort is in the coastal zone (within 12 NM of the coast) and immediately offshore in the Gulf of Carpentaria (NT Government 2019). Effort beyond 12 NM from shore is typically very low. There is no restriction on the number of licences for this fishery (NT Government 2019).	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.
A4 – NT Spanish Mackerel Fishery	×	✓	The fishery extends from the NT high water mark to the outer limit of the Australian fishing zone (NT Government 2019). The fishery employs troll lines, floating handlines and rods. The majority of the fishing effort occurs in waters near Bathurst Island, New Year Island, the Wessel Islands around to Groote Eylandt and the Sir Edward Pellew Group of islands (NT Government 2019). The target species of the fishery is the narrow-barred Spanish mackerel; however, a small number of other mackerels are also taken. The Spanish mackerel fishery is restricted to 15 licences (NT Government 2025).	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
A6 – NT Demersal Fishery	×	✓	The Demersal Fishery boundary extends from 15 nautical miles from the NT coastal waters mark to the outer limit of the Australian fishing zone, excluding the area of the Timor Reef Fishery. The fishery employs demersal trawl nets, hand and drop lines, and trap fishing methods. The main target species of the fishery are red snappers, goldband snappers, saddletail, and crimson snapper. There are currently 16 licences issued for the fishery and 7 boats nominated for fishing (NT Government 2025).	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.
A18 – NT Timor Reef Fishery	×	✓	The Timor Reef Fishery operates in remote offshore waters in the Timor Sea in a defined area approximately 8400 nautical miles north-west of Darwin. The fishery extends north-west of Darwin to the WA-NT border and to the outer limit of the AFZ and covers an area of 8,400 square nautical miles (NT Government 2025). The target species is goldband snapper, with other tropical snappers such as crimson snapper and saddletail snapper also consisting part of the catch. The majority of the fishing effort is undertaken using baited traps. There are currently 16 licences issued for the fishery and 7 boats nominated for fishing (NT Government 2025).	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.
A10 – NT Pearl Oyster Fishery	×	✓	The Northern Territory pearl oyster fishery is currently a small diver-based fishery collecting pearl shell for mother-of-pearl. Most pearl oysters used in aquaculture in the Northern Territory are reared from hatchery stock, which are grown at farms locations are in waters around Darwin and East Arnhem Land (beyond the Planning Area). Fishing for pearl oysters is diver-based, with five licences currently issued to	Given activity in the fishery is restricted to coastal waters, the operation of the Prelude facility is unlikely to impact upon the fishery. Shell considers that it is unlikely for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
			fishers. The managed fishery area extends from the high-water mark to the edge of the Australian fishing zone. As the fishery is diver-based, fishing activity is likely to be restricted to occupational diving depths (<30 m). Hence, fishing activity may only occur in a very limited part of the managed fishery area. There are five licences in the Pearl oyster fishery (NT Government 2025).	
A1 – NT Coastal Line Fishery	×	✓	The Coastal Line fishery extends 15 nautical miles from the high-water mark around the entire NT coastline. The fishery is divided into two zones, which divide the coastline at Vashon Head on the Cobourg Peninsula (NT Government 2019). The majority of fishing effort is focused around rocky reefs within 150 km of Darwin where Black Jewfish are targeted using mainly hook and line gear (NT Government 2019). Fish traps and droplines are also permitted beyond 2 NM from the coastline in the Eastern Zone of the fishery (NT Government 2019). Catch from droplines account for less than 0.8% of the total reported catch (NT Government 2019). The coastal line fishery is restricted to 52 licences (NT Government 2025).	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.
A2 – NT Coastal Net Fishery	×	✓	The NT Coastal Net Fishery extends seaward from the high-water mark to 3 nm from the low water mark and harvests a range of species, including mullets, Blue Threadfin, sharks and queenfish. The fishery is regionalised, and the five licensees can only fish in one of three discrete zones: Darwin, Gove or Borroloola. Licensees may use gill nets, and recreational fishers may use drag nets and cast nets.	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
			The coastal net fishery is restricted to 5 licences (NT Government 2025).	
A13- Trepang Fishery	×	✓	The NT Trepang Fishery extends seaward from the high-water mark to 3 nm from the coast and targets Sandfish by means of hookah diving. Sea cucumbers may only be taken by hand and must attain a minimum legal size, which differs between species. Most fishing activity is concentrated along the Arnhem Land coast, from Cobourg Peninsula to Groote Eylandt.	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.
Development (small pelagic)	×	✓	Advised by DAF-NT that there are no licence holders.	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.
A8 – NT Mud Crab Fishery	×	✓	The NT Mud Crab Fishery is confined to the tidal waters of the Top End and targets Giant Mud Crabs using baited pots. Orange Mud Crabs are also caught occasionally. Licensees may also use restricted bait nets (gill-nets). Recreational fishers may harvest Giant Mud Crabs using pots, dillies, spears, crab hooks, hook and line, hand net, cast net or drag net. There are 49 licences for crab fishing in the NT, each of which is allowed 60 pots (NT Government 2025)	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.
A7 – NT Barramundi Fishery	×	✓	The annual commercial barramundi fishing season in the Northern Territory (NT) is from 1 February to 30 September. The fishery is restricted to 14 licences. Commercial fishing for barramundi is allowed from the high-water mark to 3 nautical miles seaward of the low water mark (NT Government 2025). The fishing area is restricted to waters seaward from the coast, river mouths and legislated closed lines.	Shell considers that it is unlikely for interaction with this fishery within the Activity Area.

Fishery Industry	Activity Area	Planning area	Description	Potential for interaction within the Activity Area
			Commercial operators fish over tidal mud flats and inside a restricted number of rivers using monofilament gill nets. Nets are set and retrieved from dinghies and fish are processed onboard motherships. Barramundi and king threadfin are the primary species taken in the barramundi fishery (NT Government 2025).	

7.8.3 Aquaculture

No aquaculture operations occur within the Activity Area; typically, aquaculture is restricted to shallow coastal waters. Aquaculture in the Planning Area is dominated by the production of oysters. In the Gascoyne, this is focused on blacklip oyster *Pinctada margitifera* (Newman et al. 2024), and culture of this species is also being investigated in the Pilbara and NT (NT Government 2023b). Pearl production is carried out on a small scale in Shark Bay and Exmouth Gulf (Santos 2022). However, the most significant production involves pearls from the oyster species *Pinctada maxima*. Pearl oysters for seeding are obtained from wild stocks and supplemented by hatchery-produced oysters, with major hatcheries operating at Broome and the Dampier Peninsular (Newman et al. 2024). Pearl farm sites are located mainly along the Kimberley coast, particularly in the Buccaneer Archipelago, in Roebuck Bay and at the Montebello Islands. In the NT, pearl oysters are farmed in Bynoe Harbour, Beagle Gulf, Cobourg Peninsula and Croker Island, and around islands northwest of Nhulunbuy (NT Government 2023b).

Finfish aquaculture in the Kimberley region is dominated by barramundi farming within the Kimberley Aquaculture Development Zone. Located about 200 kilometres north-east of Broome, this zone encompasses almost 2,000 hectares of coastal waters within Cone Bay. As of 2024, there were two operators licenced to grow up to 20,000 t/pa of barramundi and other marine finfish in the zone (Newman et al. 2024).

An indigenous project at One Arm Point operates a marine hatchery that focuses on a variety of ornamental and edible marine species.

Aquaculture fishing interests were identified within or in proximity to the planning area by DPIRD during consultation.

7.8.4 Tourism and Recreation

The northern and north-western regions of Australia are considered important visitor destinations for Australian and international tourists. Water-based tourism and recreational activities such as recreational and charter fishing, swimming, snorkelling/diving, wildlife watching and boating could occur within the Planning Area. However, these activities are generally concentrated in coastal waters and around inshore islands near population centres along the mainland coast. There are no known regular recreational fishing activities that occur within the Activity Area due to the distance from shore (e.g. access to the Activity Area would take >15 hours (assuming high vessel speeds of 30 km/h) from the nearest port (Broome, WA), however there is a potential for transiting tourism vessels.

No tourism activities are known to occur within the Activity Area, but they do occur widely in the Planning Area. Most tourism within the Planning Area is nature-based and is typically associated with outstanding natural features such as the Kimberley coastline and the offshore reefs and islands (such as Ashmore Reef). Due to the remoteness of the Planning Area, most offshore tourism activities are organised expeditions, which use larger vessels.

Tours, charters and luxury cruises provide annual expeditions to Scott Reef, Seringapatam Reef, Ashmore Reef and Cartier Island (Newman et al. 2024) to provide fishing, wildlife watching, snorkelling and diving activities. Offshore islands, coral reef systems and continental shelf waters are increasingly targeted by fishing-based charter vessels (Newman et al. 2024). Recreational anglers typically target demersal and pelagic fish species for consumption and sport. Seasonal aggregations of marine megafauna, such as whale sharks, manta rays, sea turtles and whales, support nature-based tourism. The winter humpback whale migrations off the WA coastline provide vessel-based whale watching opportunities for charter operators.

Christmas Island and the Cocos (Keeling) Islands are popular tourist destinations for recreational fishing, snorkelling, windsurfing/kiting and diving.

7.8.5 Defence

Maritime Border Command (MBC) is enabled by Australian Border Force (ABF) and the Australian Defence Force (ADF). The MBC undertakes civil and maritime surveillance (and enforcement) within the Activity and Planning Areas (Department of Home Affairs [DHA] 2018a, 2018b). There are no Defence exercise areas within the Activity Area (Figure 7-34).

The Planning Area is within a maritime military firing practice and exercise area extending offshore administered by Department of Defence. The maritime military firing practice and exercise area extends from the Curtin Air Base, near Derby, WA (see Figure 7-34). ABF MBC undertakes civil and maritime surveillance (and enforcement) in and around the Activity Area (DHA 2018a, 2018b). Their primary purpose is to monitor the passage of suspected illegal entry vessels and illegal foreign fishing activity within and beyond Australia's EEZ, which extends to ~200 nm from the mainland (DHA 2018a). A search of the Department of Defence's Unexploded Ordnance (UXO) map indicated that no UXOs are known to occur within the Activity Area (Department of Defence n.d.) with the nearest known UXO >50 km from the Activity Area

7.8.6 Shipping

Shipping activity in the vicinity of the Activity Area is considered high. However, most shipping movements in the Activity Area are associated with the operation of the Prelude, Crux and Ichthys facilities (e.g. offtake tankers, vessels etc.). Coastal ships may potentially traverse the Activity Area from the major state and territory ports (Broome, Derby, Wyndham, Darwin), and MBC may conduct civil and maritime surveillance in and around the Activity Area to monitor the passage of illegal entry vessels and illegal foreign fishing activity (DHA 2018b).

Figure 7-35 summarises the regional shipping movements and port areas within the Planning Area.

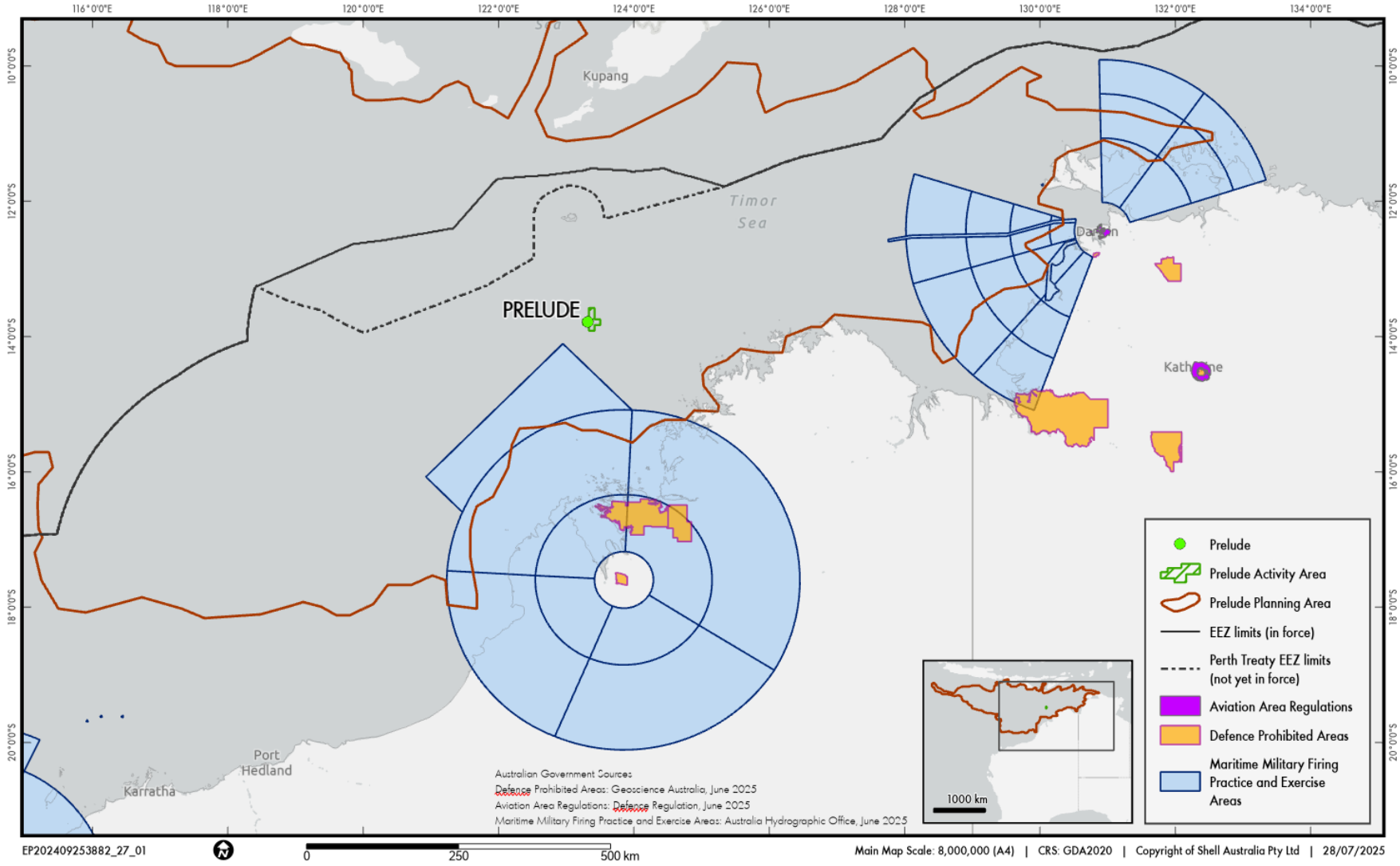


Figure 7-34: Defence Practice and Exercise Areas within or Proximal to the Planning Area

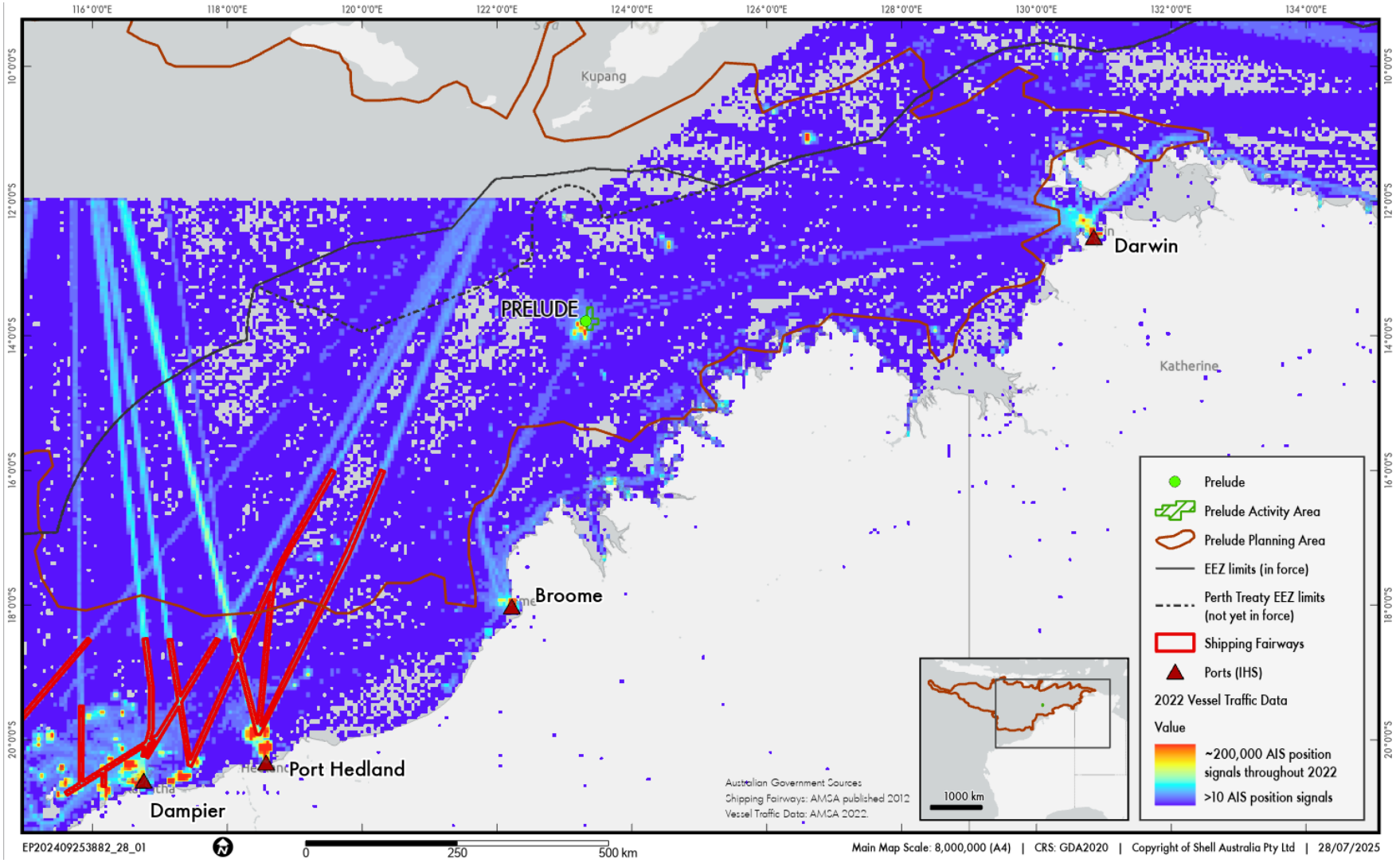


Figure 7-35: Shipping levels within the Activity Area and Planning Area

7.8.7 Scientific Research and Restoration

The Planning Area encompasses the sites for some long-term marine research and restoration programs in the north-west shelf conducted by the AIMS, various universities and industry. Some petroleum activities, such as seismic, may interrupt nearby research activities and unplanned releases have the potential to adversely affect long-term programs.

Long-term scientific research and restoration in the Planning Area includes:

- AIMS studying the Scott Reef and Ashmore Reef systems for over 20 years.
- As part of the North-west Shoals to Shore Research Program, AIMS has been conducting habitat mapping, examining the impacts of seismic surveys on fish communities and oysters, as well as looking at whale and turtle distribution on the northwest shelf.
- The Marine Biodiversity Hub a collaborative partnership supported through funding from the Australian Government's National Environmental Research Program runs a number of programs including a decade of research on river sharks and sawfishes in the region. They also focus on AMPs, sustainable resource use, threatened and migratory species and coastal habitat restoration and developed mapping and predictive tools for shallow-reef biodiversity, wastewater discharges, and the effects of ship noise and vessel strikes on large marine animals.

7.8.8 Oil and Gas Industry

Oil exploration activities in the Timor Sea commenced in the late 1960s. Since this time numerous wells have been drilled throughout the region. Petroleum exploration has been active in the Browse Basin since the 1980s, with several commercial discoveries since that time. It is expected that petroleum exploration and development activities will continue in the region into the future.

There are several operating petroleum production facilities in the vicinity of the Prelude FLNG facility. The Crux facility is interconnected to this activity situated 160 km north-east of Prelude. The Ichthys facilities are the closest, situated approximately 20 km south of the Activity Area. The Montara facility is located approximately 188 km north-east of the Activity Area.

The offshore exploration and production of oil and gas was the largest contributor ($376 million) to economic output of the marine industry in 2020–2021 with the economic output attributable to WA ($275 million) (AIMS 2023).

7.8.9 Indonesian and Timor-Leste Coastlines

The Planning Area intersects the Indonesian and Timor-Leste waters and coastlines (RPS 2025b) and is located over 300 km north of the Activity Area at the closest point. The Planning Area also overlaps international waters of southwest Indonesia and Timor-Leste, and, in the event of a worst-case hydrocarbon spill, there is a 2% probability of hydrocarbons reaching International coastlines in the worst case spill scenarios (Section 9.14.1.12).

Indonesia is the world's largest archipelagic state and Indonesian waters play an important role in the global water mass transport system (ADB 2014a). Indonesia has some of the most biologically rich coral reefs in the world with over 590 coral species having been identified. Coastal reefs are a primary source of food and income for coastal communities, as well as forming an integral part of the countries tourism industry (ADB 2014a). Coastal areas also support aquaculture production of algae, finfish and crustaceans. In addition to coral reefs, coastal habitats include sandy beaches, rocky shorelines, seagrass meadows, and mangroves.

The island of Timor is shared with Timor-Leste, which has similar coastal environmental values. Timor-Leste has a coastline of more than 700 km and a marine Exclusive Economic Zone which extends 200 nm offshore (Coral Triangle Center 2018). Timor-Leste is located in a biodiversity hotspot with a number of endemic species (ADB 2014b). The island has 30 declared protected areas, including Nino Konis Santana National Park which encompasses nearly 350 km^2 of coral reef (ADB 2014b; Coral Triangle Center 2018). The environmental values of Timor-Leste's coastline are under pressure from illegal fishing, over-exploitation of natural resources and lack of waste management (ADB 2014b).

East Nusa Tenggara is considered important to marine mammals that has the potential to be delineated and managed for conservation. The East Nusa Tenggara coastal area has numerous seagrass meadows supporting a large number of dugongs and seaweed harvesting (IUCN-MMPATF 2022).

7.9 Heritage and Cultural Features

In addition to the Commonwealth Heritage Places (see Section 7.3.1.5), there are maritime and Indigenous heritage features within the Planning Area that also have heritage and cultural importance. A description of the places within the Planning Area that are listed as World, Commonwealth or National Heritage is provided in Section 7.3.1.5.

7.9.1 Underwater Cultural Heritage

The waters within the Planning Area contain the remains of numerous vessels, aircraft and other underwater sites/artefacts that have, or may have, cultural heritage value.

Under the Underwater Cultural Heritage (UCH) Act, all (known and undiscovered) shipwrecks and sunken aircraft, and associated artefacts, older than 75 years are protected. Shipwrecks and sunken aircraft that have been underwater for less than 75 years, and other types of UCH, can be protected through an individual declaration by DCCEEW based on an assessment of heritage significance. In addition, some UCH sites may have an underwater protection zone applied under the UCH Act (DCCEEW 2023b). Shipwrecks in WA waters dating from before 1900 are protected by the *Maritime Archaeology Act 1973* (WA).

There are no declared protected UCH sites within the Activity Area. Multiple known shipwrecks, sunken aircraft, and historic (more than 75 years old) aircraft and shipwrecks and other sites occur within the Planning Area (see Figure 7-36). The closest named shipwreck to the Activity Area is the *Ann Millicent* (wrecked in 1888), ~128 km from the Activity Area. Near Ashmore Reef and Cartier Island are unnamed Indonesian fishing vessels and the *Sinar Bonerate* (wrecked in 1999).

Under the UCH Act, if an Indigenous Peoples UCH site is discovered in Commonwealth waters, it may be declared as protected under Section 19 of the UCH Act (DCCEEW 2023b). The location of the infrastructure (~250 m LAT) is below 130 m LAT which is the maximum extent of exposed land since humans have occupied the continent; hence there will not be any impacts to the tangible First Nations UCH (see Section 5) (Cosmos 2023).

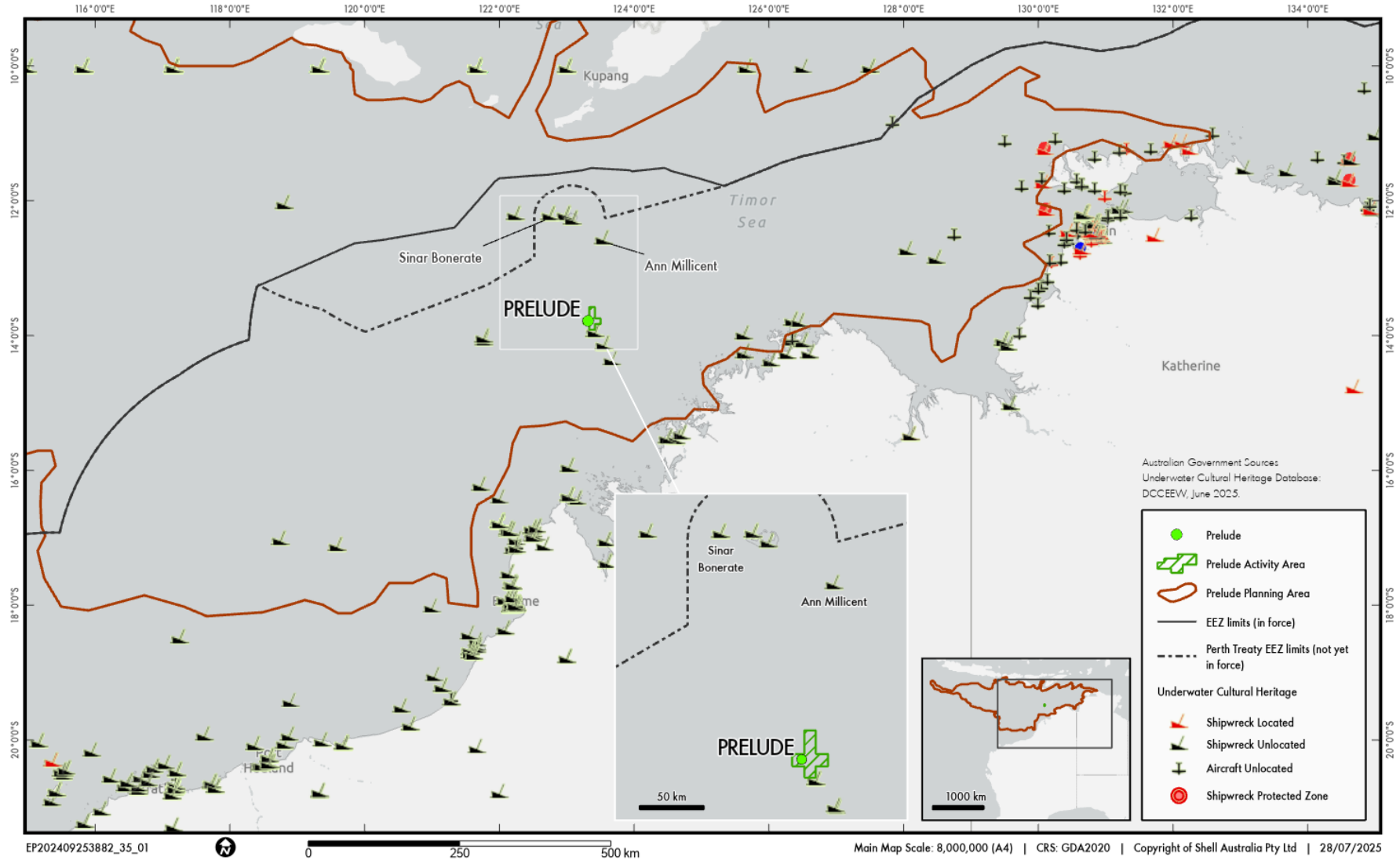


Figure 7-36: Underwater Cultural Heritage

7.9.2 Traditional Indonesian Fishing

Traditional Indonesian fishing has occurred in the waters of the Planning Area, including the islands and reefs off the northern coast of Australia, for centuries, focused on trepang (holothurians or sea cucumbers) but also targeting turtle shell, trochus shell, shark fin and reef fish (Environment Australia 2002).

In 1974, Australia recognised access rights for traditional Indonesian fishers in shared waters north of Australia, granting long-term fishing rights in recognition of the long history of traditional Indonesian fishing in the area. An MOU between the governments of Australia and Indonesia allows traditional Indonesian fishers to continue their customary practices. This area is known as the 'MOU Box' and falls within the Planning Area. The MOU Box covers Scott Reef and surrounds, Seringapatam Reef, Browse Island, Ashmore Reef and Cartier Island, representing an area of ~50,000 km^2 (Figure 7-37). The MOU Box allows Indonesian fishers to fish in designated areas using traditional methods only. These methods include reef gleaning, free-diving, hand lining and other non-mechanised methods.

The Activity Area intersects the MOU Box (Figure 7-37). Trochus, sea cucumbers (holothurians), abalone, green snail, sponges, giant clams and finfish, including sharks, are targeted by the traditional fishers. As traditional fishers primarily target shallow-water species, interaction is considered unlikely and limited to fishers transiting to reef locations. Scott Reef is currently the principal reef in the MOU Box, and the utilised season is July to October due to more favourable wind conditions, and to allow fishers to sun dry their catch on their boat decks.

Restrictions were introduced around Ashmore Reef and Cartier Island following their designation as Nature Reserves under the *National Parks and Wildlife Conservation Act 1975* (Cth) in 1983 and 2000, respectively. Restrictions permit the use of access to parts of Ashmore Reef for shelter, freshwater and to visit grave sites only.

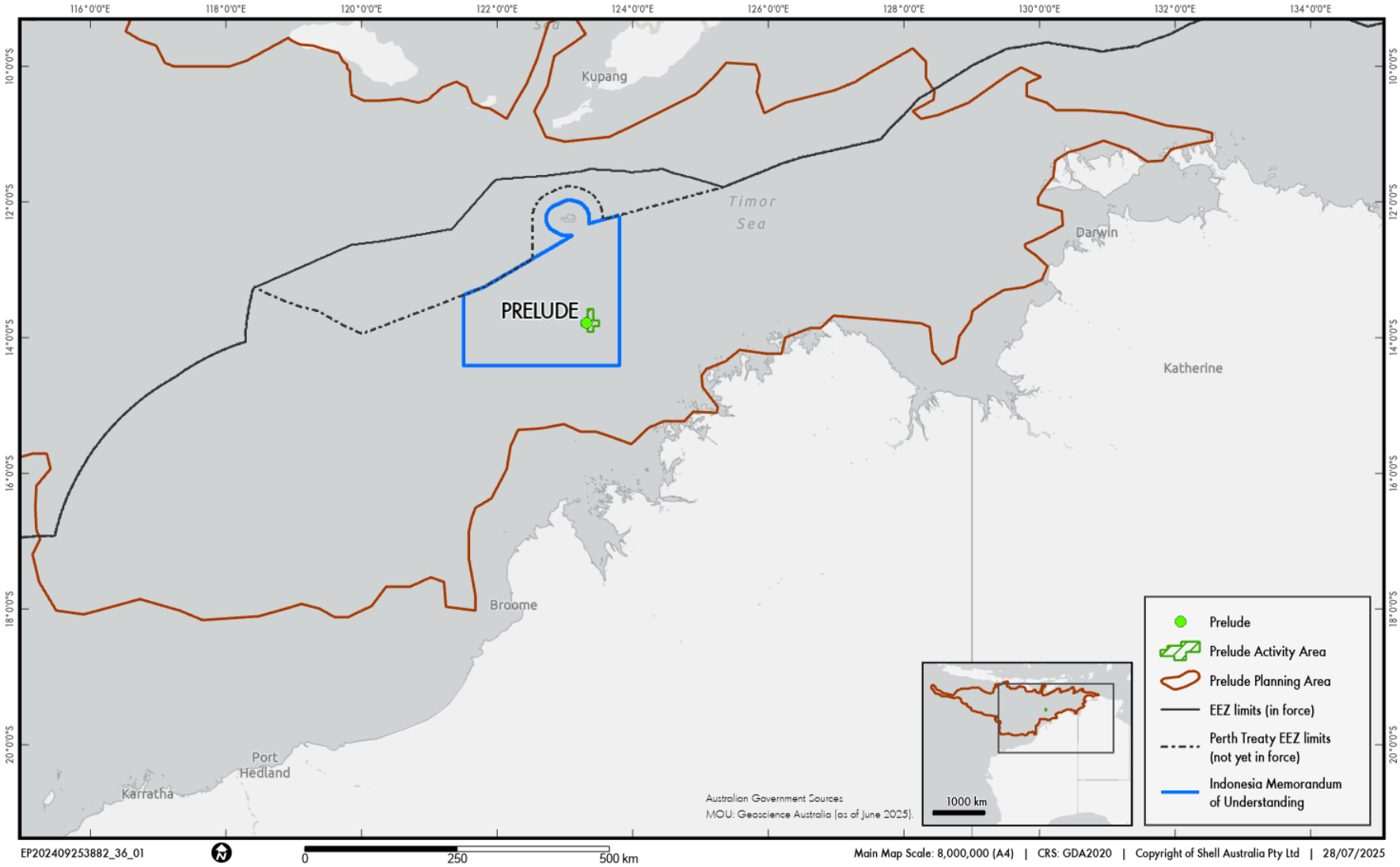


Figure 7-37: Traditional Indonesian Fishing MOU Box

7.9.3 Indigenous Cultural Connections

The Planning Area potentially overlaps or is adjacent to Sea Country of the Indigenous Peoples of Australia[18]. Shell acknowledges the decision of the Federal Court in Munkara v Santos NA Barossa Pty Ltd (No 3) [2024] FCA 9 and its interpretation of 'cultural features' – specifically, that:

- Beliefs and values (characterised as intangible cultural features of a place) must be communally held by the relevant people such that they are representative of shared cultural beliefs
- There must be a 'sufficient cogent or coherent belief that is sufficiently accepted so that it can be described as having normative content for the people or community' in order to constitute a 'cultural feature'
- The question of whether a sufficient cogent or coherent belief (that is sufficiently accepted) exists can be answered by reference to the customs and practices of the relevant people.

Section 7.10.1 describes consideration of the Indigenous cultural and social values that intersect the Planning Area.

7.9.3.1 Indigenous People and Communities

Indigenous Peoples have the oldest living cultural history in the world (NARVIS 2021). The presence of Indigenous Peoples in northern Australia dates back more than 60,000 years and is evidenced in the rich Indigenous cultural records that include some of the oldest cultural sites in Australia (Section 7.10.1.2.4) (NLC 2023a).

Country is an important concept to Indigenous People. The term Country is often used by Indigenous Peoples to describe family origins and associations with particular parts of Australia, both land and sea. The expressions Country and Sea Country are used by Indigenous Peoples to refer to the land and waters *which constitute Aboriginal traditional areas as ancestrally distinct and linguistically bounded geographic areas (*Kearney et al. 2023 p106*).* Country is inclusive of many environments that *are ecologically, geographically, ancestrally and socially configured* (Kearney et al. 2023). For Indigenous Peoples Country is a combination of the land, sea, rivers and islands and all that they contain and sustain.

Country is described further in Section 7.10.1.2

Although many Indigenous Peoples do not live permanently on traditional Country, families and individuals retain close personal and cultural connections with their Country and visit regularly for extended trips, to care for Country, find traditional foods and connect with important sites. Regular connection to Country is of significant importance for Indigenous Peoples.

Numerous different Indigenous groups have connections to different parts of Country within the Planning Area. These family groups are representative of many different Indigenous language groups, the languages of which have been spoken for millennia.

7.9.3.2 Land and Sea Tenure and Ownership

Both traditional and contemporary systems of land and sea ownership are present within the Planning Area, as described in Sections 7.9.3.2.1 and 7.9.3.2.2 respectively. The Planning Area does overlap Aboriginal freehold land boundary under *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) (ALRA), Indigenous Land Use Agreements (ILUAs) (Figure 7-41), Indigenous Protected Areas (IPAs) (Figure 7-42) and Native Title determinations (Figure 7-40).

7.9.3.2.1 Traditional Land and Sea Ownership

The marine areas located within/adjacent the Planning Area have been cared for and managed by many Indigenous Peoples for thousands of years. There are complex systems of rules, rights, customs and traditional knowledge that govern Indigenous Peoples interactions with each other and their land and Sea Country within the Planning Area.

[18] The term Indigenous People includes all people of Aboriginal and Torres Strait Islander descent.

For Indigenous People, Country is not bound by state and territorial borders or maritime boundaries distinguished by international conventions or economic jurisdiction. An example of this is evident in the answer provided by Mary Yarmirr, under cross-examination to the question of the extent of her traditional Sea Country in the 1998 Federal Court hearing of the Croker Island Native Title claim[19] and has been corroborated at various consultations with Traditional Owner groups in the development of this Environment Plan.

'*As far as my eyes can carry me'* (Mary Yarmirr 1998, cited in AHRC 2001).

Culture and ancestral features provide the necessary political distinction of traditional Country. Customary law, passed from generation to generation informs traditional land and sea ownership (NLC 2023b).

7.9.3.2.2 Contemporary Land and Sea Ownership

The Planning Area includes extensive marine and coastal areas to which Indigenous People have statutory ownership and rights, protected through the *Native Title Act 1993* (Cth) (NTA) or the ALRA. In addition, cultural and social connections are recognised through ILUAs, IPAs and other mechanisms.

The Planning Area intersects with land and sea areas on which Native Title and/or Aboriginal land rights extend.

7.9.3.2.3 Native Title

Native Title determinations provide formal recognition under Australian law of the complex cultural system of Indigenous Peoples ongoing relationships, interests, rights, and responsibilities in relation to land and sea. Native Title can be non-exclusive or exclusive and can co-exist with other property rights (e.g. pastoral leases). Native Title can exist over both land and sea estates. Indigenous Peoples and their relationship and custodianship of their Country is protected by the *Native Title Act 1993* (Cth) and any determinations made by the National Native Title Tribunal (NNTT).

The Planning Area intersects five Native Title determinations (see Figure 7-40 and Table 7-21). Whilst traditional ownership of Sea Country in some areas has been formally recognised through Native Title and Aboriginal freehold land tenure, many other Indigenous Peoples claim use of and connection to Sea Country, for example First Nations Consultative Committees formed by Top End Aboriginal Coastal Alliance.

Table 7-21: Native Title Determination Outcomes (Native Title Exists) within the Planning Area

Short Name	NNTT Tribunal Number	Includes Sea[20] (Y/N)	Registered Native Title Body Corporate (RNTBC)	State or Territory
Balanggarra (Combined)	WCD2013/005	N	Balanggarra Aboriginal Corporation RNTBC	WA
Croker Island	DCD1998/001	Yes	Top End (Default PBC/CLA) Aboriginal Corporation RNTBC	NT
Dambimangari	WCD2011/002	Yes	Wanjina-Wunggurr (Native Title) Aboriginal Corporation RNTBC	WA
Uunguu Part A	WCD2011/001	Yes	Wanjina-Wunggurr Aboriginal Corporation RNTBC	WA
Uunguu - Area B	WCD2012/003	No	Wanjina-Wunggurr Aboriginal Corporation RNTBC	WA

[19] In 1998 the Federal Court of Australia found that native title existed in relation to the sea and sea-bed around Croker Island (refer Mary Yarmirr & Ors v NT of Australia & Ors [1998] FCA 1185 (4 September 1998)).

[20] The application includes an area of sea that is bounded by the high-water mark and the exclusive economic zone limit. Source: National Native Title Tribunal 2025 with data extracted 24th June 2025.

7.9.3.2.4 Indigenous Land Use Agreements

The NNTT (2022 p16) defines an ILUA as a voluntary, legally binding agreement about the use and management of land or waters, made between one or more Native Title groups and non-Native Title interest holders in the ILUA area (such as grantee parties, pastoralists or governments).

One ILUA that has been publicly notified and/or registered, and which overlaps the Planning Area is the Dambimangari KSCS Marine Park (Table 7-22). The ILUA covers about 11,637 sq km in the vicinity of Collier Bay and Prince Recent River approximately 60 km northeast of Derby.

Table 7-22: Registered Indigenous Land Use Agreements

ILUA Name	Tribunal Number	Agreement Type
Dambimangari KSCS Marine Park ILUA	WI2016/012	Body Corporate

7.9.3.2.5 Aboriginal Freehold Land

Aboriginal land rights in the NT are supported by the *Aboriginal Land Rights (Northern Territory) Act 1976* (Cth) (ALRA) and are reflected in Aboriginal freehold land tenure. Aboriginal freehold land is unique to the NT. Aboriginal freehold land is held by a Land Trust for the benefit of the Traditional Owners and land is inalienable (i.e. it cannot be bought or sold). Aboriginal Land Councils provide support to Aboriginal Land Trusts.

Within the NT, the boundaries of Aboriginal freehold land extend to the low water mark and include both subsurface area and water. Coastal Aboriginal freehold land may encompass intertidal areas. This was affirmed in 2008 through the Blue Mud Bay decision (HCA 29) of the High Court of Australia. In northern Australia, the intertidal zone can stretch over long distances.

The Planning Area includes Territorial waters that overlap with the boundary of Aboriginal freehold land under ALRA (Figure 7-43) including Bathurst and Melville Island. With respect to the majority of Aboriginal freehold land that intersects with the Planning Area, the Northern Land Council (NLC) provides support to the respective Traditional Owners in carrying out consultation and negotiations related to future activities on the land. The Tiwi Land Council (TLC) directs and administers the Tiwi Aboriginal Land Trust (which holds the Tiwi Islands Aboriginal Freehold Land) and represents all Tiwi people in the protection of land, sea and environment.

There is no provision for Aboriginal freehold title of Aboriginal land in WA (apart from land in the south-west of WA, granted as freehold in the Noongar Boodja Settlement of 2021 that is not relevant to this plan). The Aboriginal Lands Trust (ALT) in WA manages the ALT estate which includes reserves, freehold land and pastoral leases as well as permanent settlements

7.9.3.3 Ancient Landscapes

Past coastal environments and climate played a central role in the development of early human communities (Erlandson and Fitzpatrick 2006; Rick and Fitzpatrick 2012 in Lebrec et al. 2022). There is evidence indicating that land areas that were once inhabited by humans are now submerged (O'Leary et al. 2020). Post glacial sea level rise resulted in the inundation and submergence of cultural sites covering the period from first arrival to Australia, an estimated 60,000 years ago, to the present sea level elevations that occurred around 7,500 years ago (O'Leary et al. 2020). The Ancient coastline at 125 m depth contour KEF (see Table 7-11) in the North West region (see Figure 7-10) represents the lowest sea level during Indigenous occupation (O'Leary et al. 2020; Williams et al. 2018). In 2020 researchers associated with the Deep History of Sea Country Project (Benjamin et al. 2020) reported the first confirmed ancient underwater archaeological site from the continental shelf, located off the Murujuga coastline in north-western Australia.

Shell commissioned an independent specialist consultant to undertake a desktop assessment of the potential presence of First Nations underwater cultural and social values within the Kimberley Shelf region of the Planning Area for the Crux project within the Australian EEZ. This desktop assessment then undertook a further independent peer review, completed in 2025 by ERM that confirmed the reliability of assessment completed and provided recommendations for incorporation in consultation activities with First Nations relevant persons. The Prelude Activity Area is located 160 km southwest of the Crux project and is considered comparable due to the assumptions included within the assessment. First Nations UCH was defined as all tangible and intangible cultural expressions that are associated with and claimed by Indigenous groups within

Australia (past and present) and which occurs in and is attributable to contexts that are now submerged by waters (Cosmos Archaeology 2023).

Tangible cultural heritage refers to the physical manifestation of human cultural behaviour. It is most commonly described as archaeological evidence but is inclusive of all other physical forms and material traces that are significant to a cultural group, community, a nation, and/or humanity. As the location of the study area a significant distance from the current shoreline the archaeological remains would be that associated with submerged terrestrial sites – that is First Nations sites that were inundated during last interglacial sea level rise.

Intangible heritage referred to cultural associations and imprints on the landscape that involve practices, oral traditions, ancestral narratives, performing arts, local knowledges and practices concerning nature, the environment and the universe, laws and other socio-political skills. Intangible cultural heritage exists through enactments by members of a cultural group and introduces a clear cultural right to safeguarding instruction on which is provided for by the UNESCO Convention for the Safeguarding of Intangible Cultural Heritage. Safeguarding is oriented towards recognition of the wealth of knowledge and skills that are transmitted intergenerationally.

The independent desktop assessment by Cosmos Archaeology (2023) founded:

- A detailed desktop assessment of the potential presence of First Nations underwater cultural and social values within the Kimberley Shelf region. The cultural landscape mapping was divided into 4 geographic study areas based on each area's distinctive geomorphology (Figure 7-39). These are the (1) Pilbara Zone, (2) Kimberley Zone, (3) Bonaparte Zone, (4) Arafura Zone.
- The southeastern quadrant (outside of the Activity Area) could not be assessed due to the poor quality of the publicly available marine geophysical data.
- The western half of the infield zone is below 130 m LAT (which includes all infrastructure locations covered under this EP) which is the maximum extent of exposed land since humans have occupied the continent (see Figure 7-38). As such, there will not be any impacts to the tangible First Nations UCH. The impact with intangible UCH will need to be assessed through consultation with the Gambere, Wunambul (Wunambal Gambera), Worora (Dambimangari), Umida (Wanjina Wunggurr), Unggarangi (Maylaya), Jawi and Bardi (Bardi Jawi Niimidman).

A peer review of Cosmos Archeology (2023) was completed by ERM in 2025 with key findings:

- The desktop assessment provides a comprehensive compilation of data, particularly on knowledge regarding First Nations cultural heritage and potential archaeological sites in the Kimberley Shelf.
- The authors exhibit expertise in regional archaeology and a clear understanding of underwater cultural heritage significance. The focus on the palaeo shelf area offers useful insights into submerged landforms and their relevance.
- The assessment also integrates relevant regulatory frameworks, making it a valuable starting point, especially given the limited number of similar assessments in Australia.
- Potential improvements to the assessment were identified across the use of higher-resolution data and expert input, strengthening of the palaeo shoreline reconstruction and submerged landform classification through integration of additional datasets and highlighting data limitations in further consultation with Indigenous relevant persons.

These findings were found to have not impacted the validity of the original recommendations, especially those relating to the 130 M LAT areas.

During targeted consultation, no additional information was provided by Indigenous groups regarding cultural connections to specific landforms within the Planning Area.

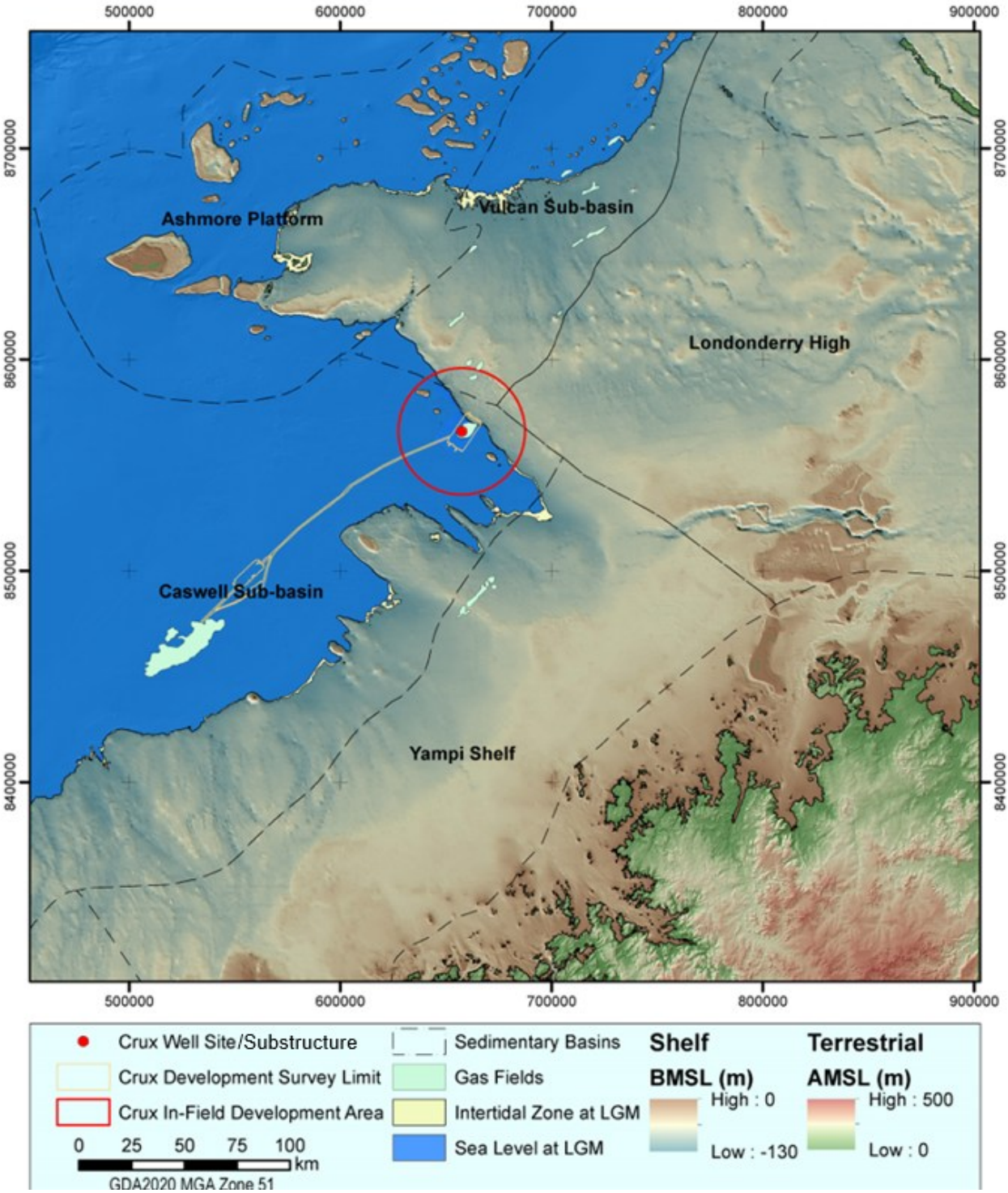


Figure 7-38: Submerged Landforms Proximal to the Activity Area (Cosmos Archaeology 2023)

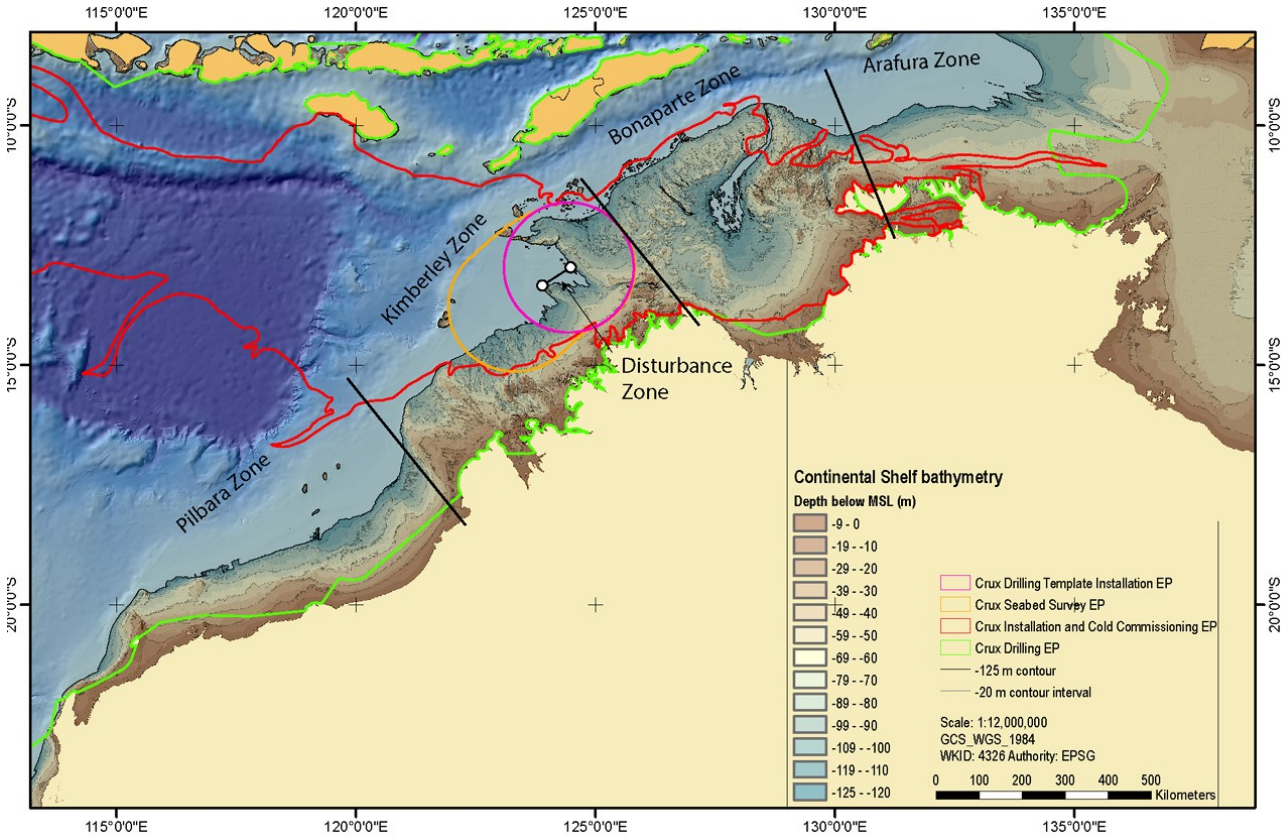


Figure 7-39: Map showing the four geographic study areas covering Australia's North West Shelf (Cosmos Archaeology 2023)

7.9.3.4 Indigenous Protected Areas

Indigenous Protected Areas (IPAs) are land and/or sea areas managed by Indigenous groups as protected areas for biodiversity conservation through voluntary agreements with the Australian Government. IPAs form a component of Australia's National Reserve System. For Indigenous Peoples, IPAs support the realisation of custodianship and stewardship obligations for Country. The boundaries of IPAs can be aligned with Native Title boundaries or wholly contained within. In 2022, the Commonwealth government announced a program (the Sea Country IPA Program) to expand the IPA network to include coastal and marine areas. Through the Sea County IPA Program, the Australian Government is seeking to strengthen the conservation and protection of the marine and coastal environments while creating employment and economic opportunities for Indigenous Peoples (NIAA 2023). Section 7.3.1 describes the marine parks (IUCN Categories V and VI) within the Planning Area that coexist with IPAs and Native Title (Figure 7-3), which promote a balance between conservation and other sustainable uses to deliver social, cultural and economic benefits for local Indigenous communities (DCCEEW 2023a). Indigenous Peoples are active participants in the management of IPAs through land and sea ranger programs and other custodian and management activities.

The Planning Area overlaps two IPAs (see Figure 7-42 and Table 7-23).

Table 7-23 describes the dedicated IPAs and IPAs in consultation, that are located within the Planning Area. The information presented in Table 7-23 is primarily drawn from DCCEEW information and augmented with publicly available information drawn for the relevant IPA Management Plans and Healthy Country Plans of Aboriginal groups with interests in the IPAs.

Table 7-23: Indigenous Protected Areas within the Planning Area

IPA Name	Status	Sea Country1	Description
Dambimangari [21]	Declared	Yes	The Dambimangari IPA, declared in 2013 has an area of 810,200 ha of land and Sea Country and is managed by the Dambimangari Aboriginal Corporation (DCCEEW 2020). The IPA is dedicated under IUCN category VI and was established to protect and conserve the natural and cultural values of the region, which is home to a diverse range of flora and fauna, including endangered species like the northern quoll, golden-backed tree-rat, and freshwater sawfish (Dambimangari Aboriginal Corporation 2012). The Dambimangari Rangers are responsible for the management of land and Sea Country. Their tasks include pest control, cultural heritage conservation, monitoring the health of plants and animals, and implementing Right-way Fire, a method of fire management that involves a mosaic of fires being burnt in the cool season to prevent wildfires in the hot, dry season.
Uunguu	Declared	Yes	The Uunguu IPA, dedicated in 2010 is located in north Kimberley and covers an area of over 760,000 ha on the land of the Wunambal Gaambera people (DCCEEW 2020). The IPA was dedicated under IUCN category VI. The Uunguu Rangers are responsible for the management of land and Sea Country. Their tasks include pest control, cultural heritage conservation, monitoring the health of plants and animals, and implementing Right-way Fire, a method of fire management that involves a mosaic of fires being burnt in the cool season to prevent wildfires in the hot, dry season. The Uunguu Rangers are also responsible for visitor management through the Uunguu Visitor Pass and have established a seasonal base at Garmbemirri on Anjo Peninsula, as well as working out of Kandiwal Community at Ngauwudu (Mitchell Plateau). The Uunguu IPA is a vital area for the Wunambal Gaambera people and requires continued conservation and management efforts (NIAA 2023).

[21] It is increasingly common to find two different spellings for the word Dambimangari: Dambimangari the contemporary spelling and Dambeemangarddee which reflects how the word is correctly pronounced in traditional language. The word Dambimangari has been adopted throughout this document.

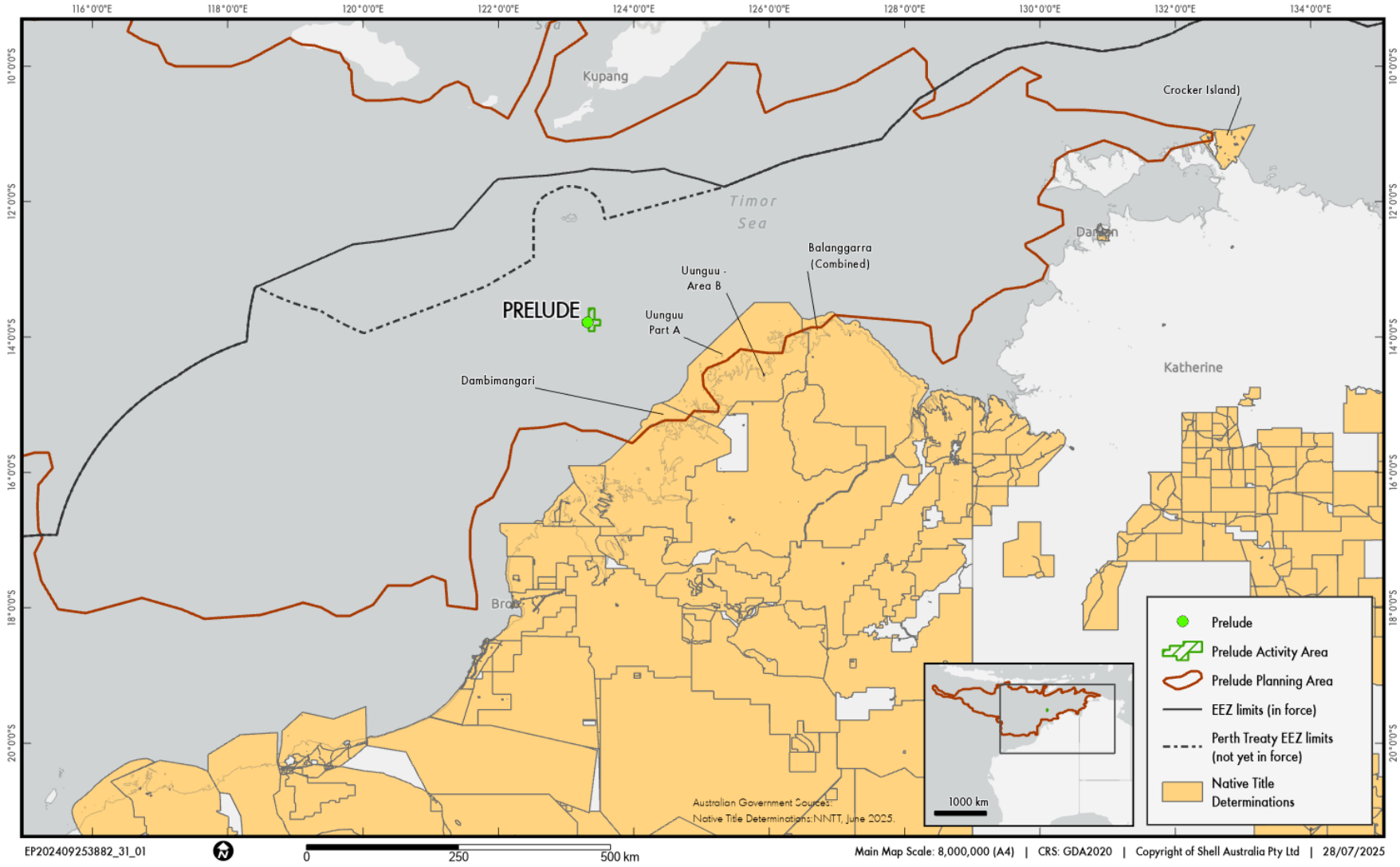


Figure 7-40: Native Title Proximal to the Planning Area

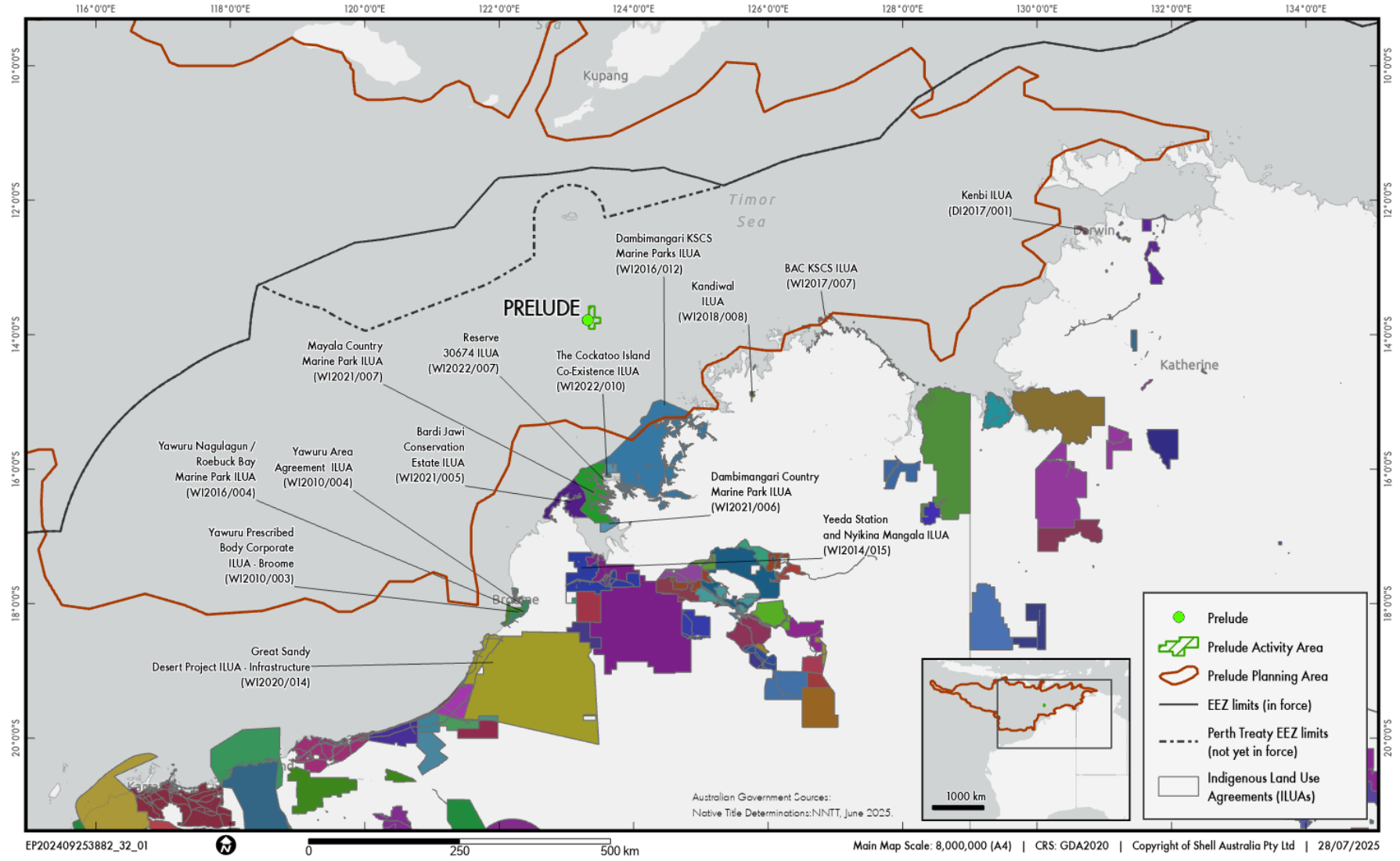


Figure 7-41: Indigenous Land Use Agreements

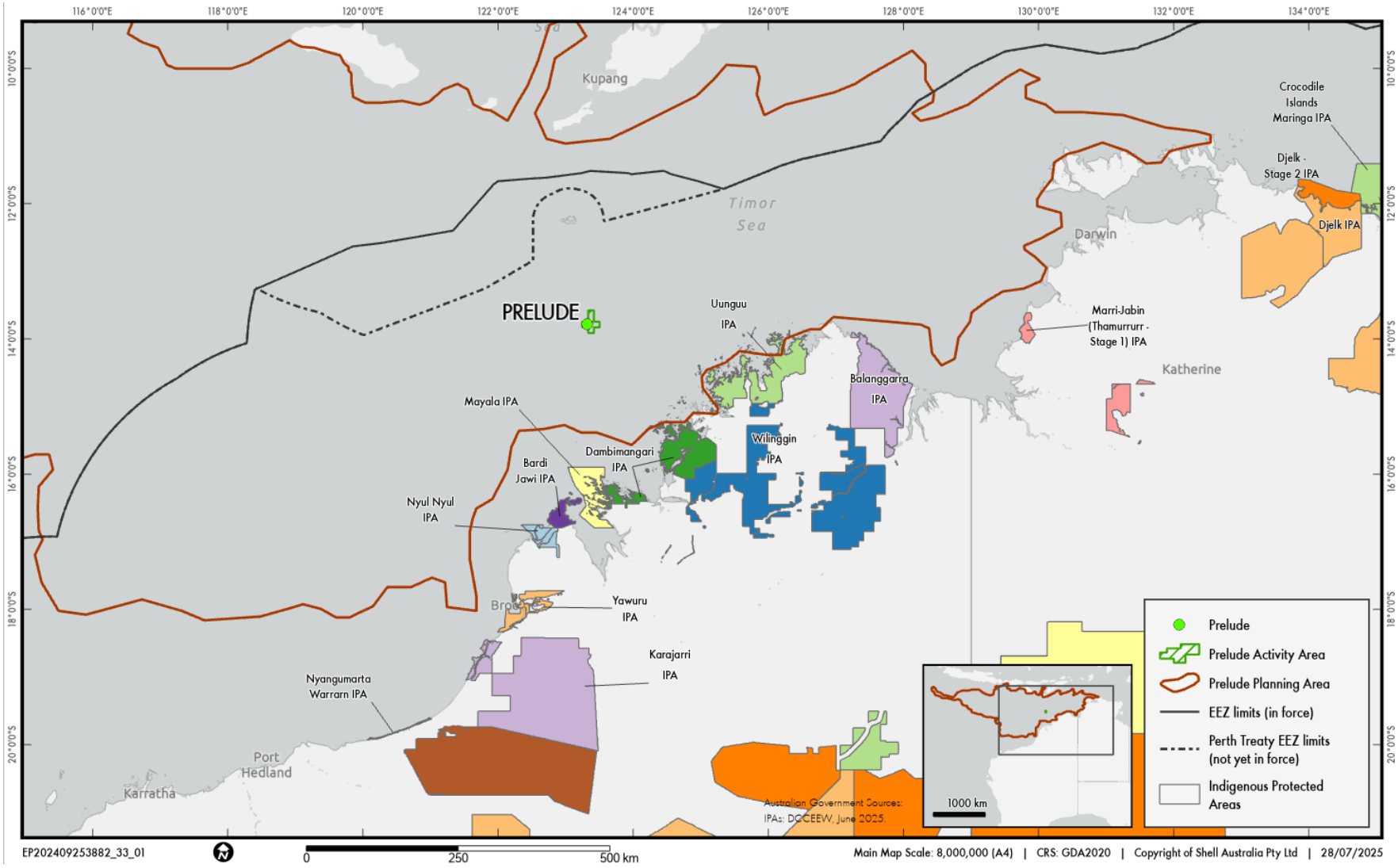


Figure 7-42: Indigenous Protected Areas

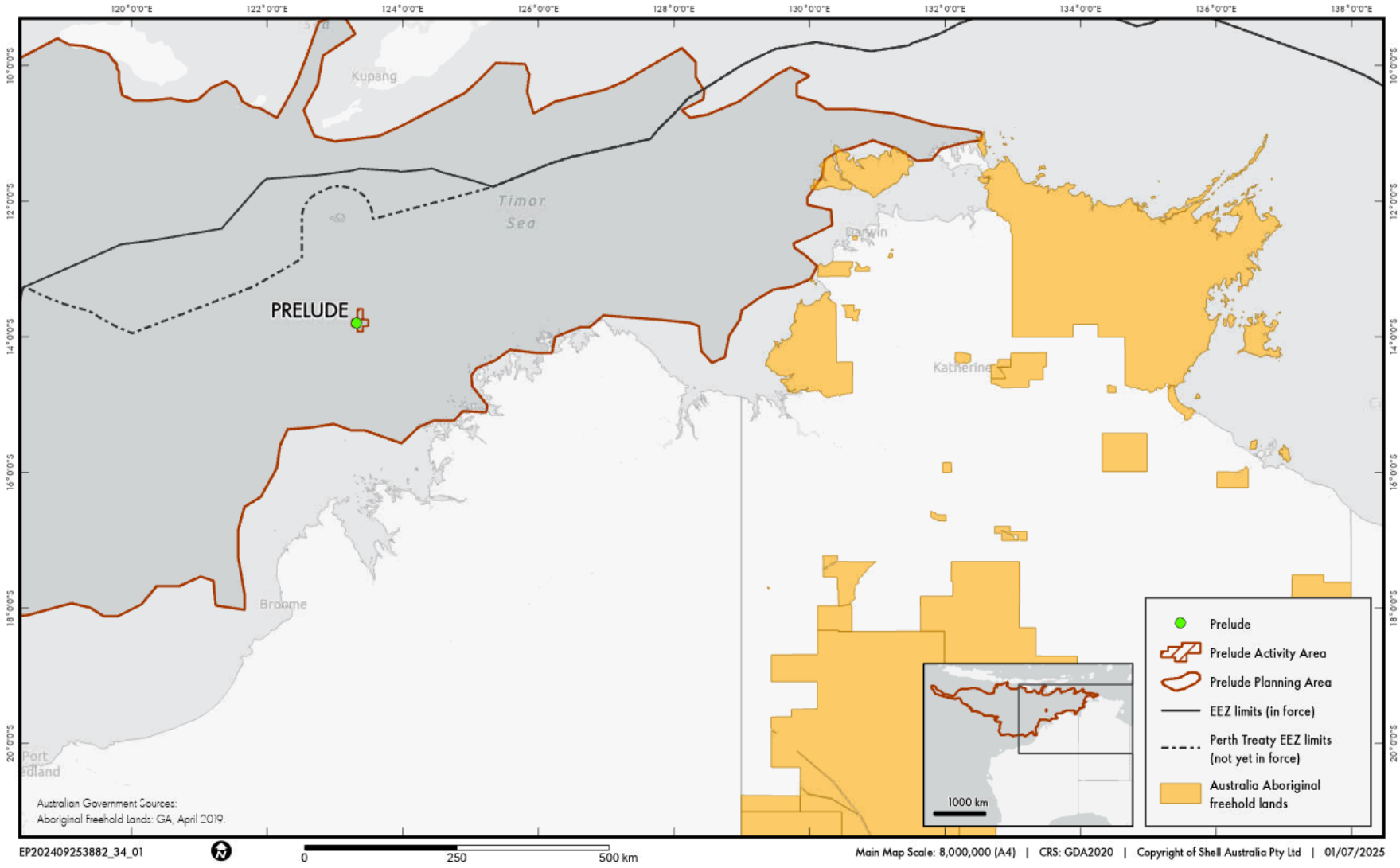


Figure 7-43: Aboriginal Freehold Land in the Northern Territory

7.10 Heritage and Cultural Values and Sensitivities

7.10.1 Indigenous Cultural Heritage

7.10.1.1 Overview

Cultural and social values and sensitivities relevant to the Planning Area are described in reference to:

- Caring for Country, including:
- Country (see Section 7.10.1.2.1)
- Law and spirituality (see Section 7.10.1.2.2)
- Traditional knowledge (see Section 7.10.1.2.2.2)
- Conservation and healthy Country (see Section 7.10.1.2.47.10.1.2.4)
- Sea resource use practices (see Section 7.10.1.3)
- Indigenous Peoples rights and interests (see Section 7.10.1.4).

Information in this section has been sourced from Joint Management Plans (JMPs) prepared for a number of protected areas (e.g. IPAs and marine reserves), Commonwealth government and Aboriginal Land Council websites, Healthy Country Plans prepared by various Indigenous organisations and books published by Dambimangari and Wunambal Gaambera Aboriginal Corporations:

- Nyara Pari Kala Niragu (Gaambera): Gadawara Ngyaran-gada (Wunambal): Inganinja Gubadjoongana (Woddordda): We are coming to see you (2021)
- Karadada, J. et al. (2011). Uunguu Plants and Animals: Aboriginal Biological Knowledge from Wunambal Gaambera Country in the North-west Kimberley
- WGAC (2021). Wunambal Gaambera Healthy Country Plan, 2021-2030
- WGAC (2023) Uunguu Inddigenous Protected Area: Wundaagu (Saltwater) Country, Plan of Management 2021-2030.

The purpose of this section is to highlight the many and varied cultural and social values of Indigenous Peoples and the associated interests and activities that may overlap the Planning Area, and in particular, Sea Country. The following sections avoid detailed descriptions of specific areas of cultural significance including cultural heritage sites and sites associated with songlines and dreaming stories and also avoids reproduction of Dreaming stories. This information is retained in confidential ownership by the associated Indigenous group.

7.10.1.2 Caring for Country

7.10.1.2.1 Country

The coastal areas, islands and surrounding waters of northern Australia have been used and occupied by Indigenous Peoples for thousands of years. The water and lands are components of Indigenous cultural landscape that are of enormous significance to Indigenous Peoples.

For Indigenous Peoples, Country is homeland, where culture, history, traditions and social structures are embedded, connected and find full meaning. Custodianship means caring for Country (i.e. land and water, plants and animals) as if land and seas are kin (Janke et al. 2021).

Country is filled with relations speaking language and following Law, no matter whether the shape of that relation is human, rock, crow, wattle… Country is family, culture, identity. Country is self. (Kwaymullina 2005)

In the context of the Planning Area, many elements within Sea Country form significant components of Indigenous Peoples culture, including their history, dreaming and creation stories (discussed in Section 7.10.1.2.2. Marine life, cultural sites, and places of significance are directly connected to the wellbeing and everyday life of Indigenous Peoples. The health and wellbeing of Sea Country is one and the same as the health and wellbeing of Indigenous Peoples. Hence any potential changes in the condition of Sea Country (such as that which could result from activities associated with the activity) may have implications for the health and wellbeing of Indigenous Peoples who may have connection to the affected Sea Country area.

Many Indigenous Peoples with traditional land and Sea Country within or adjacent to the Planning Area (e.g. the Wunambal Gaambera People and Balanggarra People) refer to themselves as Saltwater People – people who have a vibrant and traditional society based on a deep relationship with Sea Country.

7.10.1.2.2 Law and Spirituality

Indigenous law and spirituality are intertwined with the land, the people and creation. Indigenous law and spirituality reinforce culture and sovereignty. Indigenous Peoples have a complex system of law (also referred to as lore), that preceded European arrival. The term law refers to the stories, customs, beliefs and spirituality of Indigenous Peoples. Law is passed on through generations—through songs, stories, and dance and it guides how Indigenous Peoples live their everyday lives.

For Indigenous Peoples customary law provides the rules and responsibilities for looking after culture, plants, animals, people and Country. Customary law and protocols provide rules on how to interact with the land, kinships and community. Different Indigenous groups have different law systems, and many are strongly related to creation stories such as the *La Lai* of the Dambimangari people or the Wanjing and Wunggurr of the Wunambal Gaambera people and the Wolara the Creator, of the Balanggarra people (Native Title holders within the Planning Area).

7.10.1.2.2.1 Songlines and Totemic Systems

Songlines are the Indigenous travel routes that crossed the Country (land and sea), linking important sites, locations and clans. Songlines are maps of the land and sea. Songlines include dreaming pathways or tracks—forged by Creator Spirits during the Dreaming. Many of these songlines have specific ancestral stories attached to them. Literature reviews indicate that songlines exist along the coast of northern WA and the NT. There are sacred sites entwined with the songlines. For Saltwater People, stories and songlines locate, interpret and inscribe knowledges of the dreaming tracks, bodies and movements of ancestral beings that crisscross Sea Country. A number of the natural features within/adjacent the Planning Area (e.g. islands, reefs and coastline features) form core components of Dreaming stories for different Indigenous Peoples.

Different language groups have different accounts of the Dreaming as well as different bodies of law and customs. For example, for the Tiwi people (Traditional Owners of the Tiwi Islands) the sea is where life begins. The ocean (*Winga*) is deeply embedded in Tiwi culture through song, dance, design and ceremony.

For the Balanggarra people the saltwater and islands of Balanggarra Sea Country are Dreaming creations (BAC 2011). The saltwater was created by Wolara as he ‘poled his canoe’ in the coastal regions. The pole of Wolara also created some of the islands in Balanggarra Sea Country (Balanggarra Ventures Ltd 2021). The King George River and Berkley Rivers (outside of the Planning Area) are of high cultural significance to the Balanggarra people. King George Falls are the male and female Wungkurr (Department of Parks and Wildlife 2016).

The Dreaming creation events of the Dambimangari people illustrate a deep spiritual connection to Country and speak to the importance of saltwater resources. There are Dambimangari creation stories associated with the *Jimbirridy* (Rock-cod) and the baler shell – two *Wandjina* beings from which the Prince Regent River, Saint George Basin and St Andrew Island were created. This creation story forms the basis for the logo of the newly created Lalang-gaddam marine park (Section 7.10.1.2.4.4) (DCBA 2022a). There are also stories about the whales and creation of the coastline of Dambimangari Sea Country.

Totems connect Indigenous Peoples on a spiritual level, providing a deeper connectivity and understanding to their family groups, their Country, Dreaming and creation events. Many of the marine species (such as whale sharks, sawfish, whales, turtles) found within the Planning Area are of totemic value to different Indigenous Peoples (see Section 7.7.10 (WCA n.d.). Marine animals and plants found in Sea Country hold special cultural significance to different Indigenous Peoples and may be important for subsistence and medicinal purposes. For example, the dugong and marine turtle are both of high cultural value to the Wunambal Gaambera people, Balanggarra People and many other Indigenous groups (Karadada et al. 2011). Marine turtles are a key food source for Saltwater People (WWF n.d.).

7.10.1.2.2.2 Traditional Knowledge and language

Indigenous Peoples have strong and extensive traditional knowledge (both cultural and ecological) of their Country and natural processes. This knowledge has been used for thousands of years to maintain a sustainable balance between the use and care of their natural environment. This knowledge is alive today and

evident in law, culture and practices. Traditional knowledge requires the building up of understanding over time and can be defined as a 'cumulative body of knowledge, practice and belief' (Berkes 2008 p7 in Kearney et al. 2023). Indigenous Peoples are increasingly concerned about the difficulties in being able to pass on their traditional knowledge. Active and ongoing participation in land and sea management is a means by which Indigenous Peoples are seeking to improve the intergenerational transfer of knowledge, critical to future health of land and Sea Country.

7.10.1.2.3 Intergenerational Knowledge Transfer

Older Indigenous Peoples, in particular those who are senior, cultural leaders or law-people are responsible for passing on traditional cultural and ecological knowledge to young people. Knowledge transfer is traditionally undertaken on-Country through the sharing of stories, song and dance, participation in ceremony and rituals, making tools, engaging in land and resource use activities (e.g. hunting, fishing), learning about bush tucker and traditional medicine. Maintaining easy access to traditional Country and traditional resources (e.g. Sea Country resources) and ensuring protection of important cultural heritage sites is imperative for the ongoing transfer of traditional knowledge.

Indigenous children learn about customary laws and protocols through many avenues including observing and participating in customs and ceremonies such as songs and dances on Country. Such laws, traditions and customs do not exist in the past as historical practices, but are considered living, contemporary and vital.

7.10.1.2.4 Conservation and Healthy Country

7.10.1.2.4.1 Biological and Ecological Values

For Indigenous Peoples, Sea Country is rich in cultural, biological and ecological values. Fish, marine mammals and sea birds, coral and fringing reef communities are all important components of biodiversity values (see Sections 7.6 and 7.7). Managing and conserving the ecological values of Sea Country is important to Indigenous Peoples with custodial responsibilities for Sea Country, and to the broader Indigenous community.

7.10.1.2.4.2 Contemporary Land and Sea Management

Management Plans and Joint Management

Indigenous sea management in areas adjacent the Planning Area is undertaken in accordance with the objectives of key plans including Healthy Country Plans, IPA Management Plans and JMPs. Healthy Country Plans are contemporary representations of Indigenous land and sea management and represent the way Indigenous Peoples can manage and implement their traditional knowledge, whilst still looking after Country in ways prescribed by the old people.

Many IPAs have corresponding Healthy Country Plans or tailored management plans (e.g. Uunguu Indigenous Protected Area: Wundaagu (Saltwater) Country, Plan of Management 2021-2030 [WGAC 2023]), prepared by each relevant Indigenous group. Healthy Country Plans, IPA management plans and JMPs for marine areas articulate Indigenous Peoples aspirations for Country and seek to fulfill their cultural responsibility to look after Country.

Land and Sea Ranger Programs

Land and sea rangers work on land and Sea Country across tenure, including Native Title lands and protected areas. Many of the land and sea ranger programs across WA and NT are supported by the Commonwealth and State funding. Land and sea rangers care for Country, combining traditional knowledge of Country with contemporary training and experience. Rangers are engaged in protecting and monitoring the health of Sea Country, including marine species such as turtle and dugong. Many of the land and sea ranger programs are delivered as part of broader Aboriginal Land Council or Aboriginal Corporation operations.

Recent studies have also found that IPAs and associated ranger programs contribute considerable social, cultural and environmental benefits for local Indigenous people, including the general Australian public (SVA 2016; Austin et al. 2017). Native Title, IPAs and JMPs for Country give strength and security to Aboriginal people to look after Country.

7.10.1.2.4.3 Cultural Heritage Sites and Protection

For Indigenous Peoples, the protection of sacred and significant cultural sites forms a central focus of looking after Country. Cultural sites can tell different narratives about creation, Indigenous lore (law) and history. All Country is considered a cultural place, and there are rules and requirements for how Indigenous Peoples look after it. Healthy Country Plans and IPAs help Indigenous Peoples look after cultural heritage sites. For example, Mayala Country Plan 2024 sets their strategic approach and priorities for Country: to look after, enjoy and use their Country sustainably for future generations. The plan sets out strategic goals to ensure Country is cared for, knowledge is maintained, access to Country is managed and sustainable, young people are empowered, and partnerships are in place to benefit the Community. Aboriginal Land Councils and Aboriginal Corporations, together with Land and Sea Rangers work together to control access to cultural heritage sites and sacred areas including Sea Country sacred sites.

Cultural sites are specific sites identified and protected through Australian law, and which include particular places of importance to Indigenous Peoples, in a broader landscape of cultural significance.

The overlap of the Planning Area with sites of Aboriginal cultural heritage is described in the following sections. A search of the WA Department of Planning Lands and Heritage Aboriginal heritage places and Aboriginal heritage surveys datasets identified 59 registered Aboriginal sites and 60 lodged Aboriginal heritage places within the Planning Area. There were no registered or lodged Aboriginal Sites within the Activity Area. Not all cultural sites are recorded or registered and captured through database searches. This can be attributed to a number of reasons including but not limited to distrust of government and desire to keep important sites private.

A search of the NT AAPA Sacred Sites Register was undertaken in 2023 and refreshed in 2026 to identify potential sacred sites (registered and recorded) that overlap with the Planning Area. The term sacred site is defined in Section 3 of the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT) by reference to its meaning in the ALRA which provides a sacred site is:

'a site that is sacred to Aboriginals or is otherwise of significance according to Aboriginal tradition, and includes any land that, under a law of the NT, is declared to be sacred to Aboriginals or of significance according to Aboriginal tradition'.

Based on information provided by AAPA there are four registered[22] sacred sites, and no burial sites orother sites[23] located within the Planning Area. The registered sacred sites are predominantly located along the mainland and island coastlines within the intertidal zone from the Tiwi Islands to Croker Island.

7.10.1.2.4.4 Protected Areas

Section 7.3.1 describes the protected areas within the Planning Area including marine parks and Commonwealth heritage places. As outlined in Section 7.9.3.4 there are two IPAs within the Planning Area. There are tangible and intangible Aboriginal cultural and social values associated with these protected areas, particularly IPAs. as described below.

Cultural and Social Values of Indigenous Protected Areas

There are 2 IPAs located wholly or partially within the Planning Area (Figure 7-42). IPA enable Aboriginal people to protect land and Sea Country, keep traditional law and protect cultural values such as sacred sites, Songlines and totems.

A summary of cultural and social values associated within the IPAs that intersect with the Planning Area is presented below. These values were identified through a literature review of the Healthy Country Plans associated with each IPA, and in particular the Healthy Country Plans of the Dambimangari, Bardi Jaw, Mayala and Djelk peoples. The description of values focusses principally on Sea Country elements as these overlap the Planning Area.

Protection of reefs, beaches and islands. Particular reefs, beaches and islands can be special places for different Traditional Owners. Some islands have burial sites, rock art, stone arrangements, artefact scatters

[22] A registered sacred site is a site that has been added to the Register of Sacred Sites maintained by the AAPA following the process set out in Part III Division 2 of the *Aboriginal Sacred Sites Act 1989* (NT).
[23] Other sites include archaeological places or sacred objects. These places and objects are protected under the *Heritage Act 2011* (NT).

and shell middens dating back thousands of years. Visiting and looking after islands is critically important to Traditional Owners. Some beaches hold important stories (e.g. Dambimangari people). For some Traditional owners (e.g. Bardi Jawi, Dambimangari and Mayala peoples) reefs, particularly fringing reefs can be important traditional food sources and gathering places for Traditional Owners and visitors. For example, Montgomery reef is an important hunting ground for the Dambimangari people. For the Mayala people, the reefs provide a rich food source and a place to collect materials such as baler shell. Some reefs are also of cultural significant. An example of this is Jarlarn, a fringing inshore reef off the coast from Ardyaloon. This reef is also important for the Bardi Jawi people.

Protection of saltwater fish. Resources from the sea, particularly fish resources are particularly important to Aboriginal people. Fish resources are the most available food on Sea Country. Finding fish and seasonal fishing arrangements are passed on as traditional knowledge. Hunting is undertaken seasonally and in accordance with traditional knowledge. Traditional Owners of Sea Country hold the view that all animals from the sea are healthy when the seawater they are living in is healthy.

Protection of important marine species (e.g. fish, turtle and dugong). Fish and turtle (particularly green turtle) are important traditional foods for many Aboriginal people. Traditional hunting of marine species such as turtle and dugong is a significant component of culture, ongoing connection to Country and traditional knowledge transfer. Dugong are hunted for ceremonial purposes by many coastal Aboriginal groups.

Protection of sites of cultural significance. The protection and maintenance of significant sites of culture heritage for Traditional Owner enjoyment is a common value across all dedicated IPAs. Some cultural sites are associated with Aboriginal law and Songlines and are important for the intergenerational transfer of traditional knowledge. Traditional Owners have a cultural obligation to visit important sites of cultural significance to check on their health, and to preserve their health.

The values and sensitivities described above are likely to underpin Traditional Owner concerns about potential damage to coastal areas, or pollution of seawater in the Planning Area.

Commonwealth and National Heritage Places

Section 7.3.1.5 describes and Figure 7-5 illustrates the Commonwealth heritage places within the Planning Area. Table 7-24 summarises the defined Aboriginal cultural and social values associated with some of these protected areas.

Marine Parks

Figure 7-2 and Figure 7-3 illustrates and Table 7-3 lists the marine parks within the Planning Area. The Aboriginal cultural values of the AMPs are described in the various AMP Network Management Plans (DNP 2018 a,b,c).

The primary Indigenous value associated with the marine parks relate to the use of Sea Country and support custodial obligations to care for Country. Sea Country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their Sea Country for tens of thousands of years. Table 7-24 summarises the Indigenous cultural values within the marine parks that overlap the Planning Area.

Table 7-24: Cultural Values and Sensitivities of Protected Areas within the Planning Area

Listed Place	Cultural Values	Distance from Activity Area (~km)	Distance from Prelude (~km)
Commonwealth Heritage Places			
Ashmore Reef National Nature Reserve	Ashmore Reef is significant for its history of human occupation and use (DCCEEW 2023). Ashmore Reef National Nature Reserve, a marine protected area in the Timor Sea, is significant for its unique and pristine coral reef ecosystem, which is home to over 240 coral species and more than 500 fish species. The reserve serves as a vital nesting site for green turtles and supports globally significant populations of seabirds, including	146	162

Listed Place	Cultural Values	Distance from Activity Area (~km)	Distance from Prelude (~km)
	the threatened roseate tern. Additionally, Ashmore Reef is recognised for its critical role in the migration of humpback whales and for its importance as a feeding ground for numerous marine species, making it a site of great ecological value and scientific interest (Parks Australia, No date) Many of the marine species (see Section 7.3.1.5) that use the marine waters of Ashmore Reef are of cultural (including totemic) importance to Indigenous Peoples.		
Mermaid Reef-Rowley Shoals	Mermaid Reef, one of the three coral atolls comprising the Rowley Shoals in Western Australia, is significant for its exceptional biodiversity, including over 200 coral species and over 650 fish species, making it a hotspot for marine research and a popular destination for diving enthusiasts who can witness stunning coral formations, giant clams, reef sharks, and other remarkable marine species in its crystal-clear waters. Its remote location and protected status further contribute to its significance as a well-preserved and relatively undisturbed marine ecosystem (Parks Australia, No date)	558	535
Scott Reef and surrounds	Scott Reef is significant due to its rich biodiversity and ecological importance as a diverse and thriving marine ecosystem, providing habitat for a wide range of species, including endangered and vulnerable ones, and serving as an important breeding and feeding ground for marine life in the region (AIMS 2013). Many of the marine species (see Section 7.3.1.5) that use the marine waters of Scott Reef and surrounds are of cultural (including totemic) importance to Indigenous Peoples.	142	154
National Heritage Places (NHP)			
West Kimberley NHP	The West Kimberley NHP is significant for its Aboriginal and historic values including the history of the *gaalwa* (double log raft) and the use of *gooward* (pearl shell) for ceremonial purposes and trading far afield by the Bardi and Jawi people.	167	171
Australian Marine Parks			
Argo-Rowley Terrace	Sea Country is valued for Aboriginal cultural identity, health and wellbeing. Across Australia, Aboriginal people have been sustainably using and managing their Sea Country for tens of thousands of years.	317	324
Ashmore Reef	Aboriginal People: Sea Country is valued for Aboriginal cultural identity, health and wellbeing. Across Australia, Aboriginal people have been sustainably using and managing their Sea Country for tens of thousands of years (DNP 2018a). Tourism, recreation and scientific research are important activities in the Marine Park. These activities contribute to the wellbeing of regional communities and the prosperity of the nation (DNP 2018a). Indonesian People: The Ashmore Reef AMP contains Indonesian artefacts and grave sites, and Ashmore lagoon is still accessed as a rest or staging area for traditional Indonesian fishers travelling to and from fishing grounds within the MoU Box (DNP 2018a).	141	163

Listed Place	Cultural Values	Distance from Activity Area (~km)	Distance from Prelude (~km)
Cartier Island	Sea Country is valued for Aboriginal cultural identity, health and wellbeing. Across Australia, Aboriginal people have been sustainably using and managing their Sea Country for tens of thousands of years.	110	134
Joseph Bonaparte Gulf	Sea Country is valued for Aboriginal cultural identity, health, and wellbeing. Across Australia, Aboriginal people have been sustainably using and managing their Sea Country for tens of thousands of years. The Miriuwung, Gajerrong, Doolboong, Wardenybeng and Gija and Balangarra people have responsibilities for Sea Country in the Marine Park. They are represented by the following PBCs: Miriuwung and Gajerrong Aboriginal Corporation, and Balanggarra Aboriginal Corporation. These corporations are the points of contact for their respective areas of Sea Country in the Marine Park. The NLC and the KLC are the NTRBs for the Northern Territory's northern region, and the Kimberley region.	579	603
Kimberley	The Wunambal Gaambera people, Dambimangari, Mayala, Bardi Jawi and the Nyul Nyul people's Sea Country extends into the Kimberley AMP. The Wunambal Gaambera people's Country includes daagu (deep waters), with about 3,400 km^2 of their Sea Country located in the AMP. Sea Country is culturally significant and important to the identity of these Aboriginal groups. The Wunambal Gaambera, Dambimangari, Mayala, Bardi Jawi and the Nyul Nyul people have an unbroken connection to their Sea Country, having deep spiritual connection through Wunggurr (creator snakes) that still live in the sea. Staple foods of living cultural value include saltwater fish, turtles, dugong, crabs and oysters. Access to Sea Country by families is important for cultural traditions, livelihoods and future socio-economic development opportunities. The national heritage listing for the West Kimberley recognises these key cultural heritage values: • Wanjina Wunggurr Cultural Tradition which incorporates many Sea Country cultural sites. • Log-raft maritime tradition, which involved using tides and currents to access warrurru (reefs) far offshore to fish. • Interactions with Makassan traders around sea foods over hundreds of years. • Important pearl resources that were used in traditional trade through the wunan and in contemporary commercial agreements. The Wunambal Gaambera, Dambimangari and Bardi Jawi people consider that these values extend into the Kimberley AMP. The Wanjina Wunggurr is law of the Wunambal Gaambera and Dambimangari people and it is recognised that all of the Sea Country, land, plants and animals were put there by Wanjina Wunggurr. Under Wanjina Wunggurr law, the Wunambal Gaambera and Dambimangari people have a responsibility to manage country, to maintain the health of the Country and all living things. The Wunambal Gaambera, Bardi Jawi, Mayala and the Nyul Nyul people have had Native Title determined over parts of their Sea Country included in this park (DNP 2018a).	94	113
Mermaid Reef	Sea Country is valued for Aboriginal cultural identity, health and wellbeing. Across Australia, Aboriginal people have been sustainably using and managing their Sea Country for tens of thousands of years.	516	524

Listed Place	Cultural Values	Distance from Activity Area (~km)	Distance from Prelude (~km)
Oceanic Shoals	Sea Country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous Peoples have been sustainably using and managing their Sea Country for tens of thousands of years. The Miriuwung, Gajerrong, Doolboong, Wardenybeng and Gija and Balangarra people have responsibilities for Sea Country in the Marine Park. They are represented by the following PBCs: Miriuwung and Gajerrong Aboriginal Corporation and BAC. These corporations are the points of contact for their respective areas of Sea Country in the Marine Park.	300	326
WA Marine Park			
Lalang-gaddamm	The Lalang-gaddam Marine Park was created in 2022 and covers approximately 1,308,500 ha within the Dambimangari determination area (DBCA 2022a). The marine park is located on Dambimangari Sea Country. The Dambimangari IPA (Table 7-23) covers much of the terrestrial area adjacent to the marine park. The marine park is jointly managed by the DBCA and the Dambimangari Traditional Owners through the *Lalang-gaddam Marine Park Joint Management Plan* (DBCA 2022a). Dambimangar Traditional Owners are saltwater people, who continue to use both bush and sea resources within their Country. Native Title rights within the marine park are described in Table 7-21. Within the marine park, customary activities such as fishing and hunting are provided for under the management plan. The Dambimangari Indigenous Ranger Program undertakes marine operations and are a regular presence in the Lalang-gaddam Marine Park, undertaking a range of land and sea management projects, such as surveying for exotic marine pests and weeding and cleaning up land areas. The marine park contains sites of cultural significance to Dambimangari people. The marine park experiences one of the larges tidal ranges in Australia. The joint management plan for the marine park (DBCA 2022a) identifies the intertidal area as an important part of Dambimangari people's identification as saltwater people. As described in Section 7.10.1.3.1, the marine park provides foraging and nursery areas for a range of species. Many of these species are culturally important species to Dambimangari. Through Indigenous participation in decision-making, and by maintaining the Dambimangari people's cultural and spiritual relationship with Country, the establishment of the jointly managed marine park also addresses the Dambimangari people's rights as stipulated in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (DBCA 2022a).	182	198
Mayala Marine Park	The Mayala Marine Park was created in 2022 and covers an area of approximately 315,000 ha within Mayala people's native title determination area in the Buccaneer Archipelago, located off the West Kimberley coast of Western Australia. It is part of the broader Mayala Sea Country, which includes hundreds of islands, submerged lands, reefs, mangroves, seagrass meadows, and tidal zones The marine park is jointly managed by the DBCA and the Mayala Traditional Owners. The Mayala people are saltwater people with a unique island culture and deep knowledge of the complex currents and tides in their Sea Country.	220	234

Listed Place	Cultural Values	Distance from Activity Area (~km)	Distance from Prelude (~km)
	They carry the responsibilities of their ancestors to keep their Country rich, alive and healthy. The marine park features fringing reefs, mangrove creeks, seagrass meadows and has the highest tidal ranges in Australia, exceeding 11 metres.		
Bardi Jawi Gaarra Marine Park	The Bardi Jawi Gaarra Marine Park was created in 2022 and covers approximately 204,000 ha within the Bardi and Jawi Sea Country in the West Kimberley region of Western Australia. The marine park is jointly managed by the DBCA and the Bardi Jawi Traditional Owners. The Bardi Jawi people are known as saltwater people, with strong connections to the ocean, reefs, mangroves, and marine life. They have deep cultural, linguistic, and spiritual ties to both land and sea. The Bardi Jawi Gaarra Marine Park is a vibrant and ecologically rich area featuring a diverse range of natural and cultural highlights, such as a mix of fringing reefs, mangrove creeks, and seagrass meadows, supporting rich marine life including humpbackwhales, dugongs, turtles and snubfin dolphins. It also holds deep cultural significance for the Bardi Jawi people, who have lived and cared for this sea country for thousands of years. The park includes zones for conservation, cultural protection, and sustainable fishing.	250	265
Nagulagun Roebuck Bay Marine Park	The Nagulagun Roebuck Bay Marine Park was created in 2016 and covers approximately 102,000 ha of coastal and marine environment adjacent to Broome in Western Australia The marine park is jointly managed by the DBCA and the Yawuru people. Roebuck Bay is Yawuru Nagulagun, which means Yawuru Sea Country. Roebuck bay has some of the most productive tropical intertidal flats in the world, making it very important for Yawuru fishing, hunting and gathering of sea foods. The marine park includes intertidal zones, seagrass beds, mangrove forests and mudflats, which are vital habitats for species like dugongs, snubfin dolphins, marine turtles, and migratory shorebirds.	446	460

Listed Place	Cultural Values	Distance from Activity Area (~km)	Distance from Prelude (~km)
North Kimberley	The North Kimberley Marine Park covers an area of almost 2 million hectares. The long-standing connections, rights and interests of Indigenous Peoples have been recognised through Native Title determinations for the lands and waters in and adjacent to the North Kimberley Marine Park for the Wunambal Gaambera, Balanggarra, Ngarinyin and Miriuwung Gajerrong people. The Indigenous Peoples have cultural, spiritual and social connections to the north Kimberley Sea Country (DBCA 2023). The marine park is of intrinsic biological, ecological and cultural value for Indigenous Peoples, but also provides Indigenous Peoples with cultural, recreational and commercial benefits. The marine park contains many places of cultural and spiritual importance to Indigenous Peoples. Whilst most locations occur on land, many are sea related. Registered sites include those with artefacts, ceremonial and mythological paintings, fish traps, burial grounds, quarrying, many-made structures and middens (DPAW 2016). The marine park is jointly managed with Indigenous Peoples in accordance with the North Kimberley Marine Park Joint Management Plan 2016 (DPAW 2016). Joint management of the marine park provides opportunities for Indigenous Peoples to fulfill cultural obligations to care for Country, record and share cultural and language, and the intergenerational transfer of traditional knowledge.	163	185
Rowley Shoals	The Rowley Shoals Marine Park comprises Clerke and Imperieuse reefs. The marine reef fauna of the Rowley Shoals is considered to be exceptionally rich and diverse, including species typical of the oceanic coral reef communities of the Indo-West Pacific (DEC 2007). There is little information available on the Aboriginal cultural values of the marine park, however it is likely the marine area is Sea Country and valued by Aboriginal people for its contribution to cultural identity, health and wellbeing.	555	568
WA Nature Reserves[24]			
Browse Island	Many of the marine species that use the Browse Island marine waters are of cultural (including totemic) importance to Indigenous Peoples.	25	159
Niiwalarra Islands	Marine species of cultural importance to the Kwini people of the Niiwalarra Islands include turtles, dugongs, sea cucumbers, fish, and shellfish, which are central to their diet, spirituality, and traditional ecological knowledge (DBCA 2019).	323	344
Scott Reef	Many of the marine species that use the Scott Reef marine waters are of cultural (including totemic) importance to Indigenous Peoples.	138	146
Northern Territory Marine Park			
Garig Gunak Barlu Marine Park	The following information has been sourced from the DCCEEW (2021). Garig Gunak Barlu National Park includes the entire Cobourg Peninsula, the surrounding waters of the Arafura Sea and Van Diemen Gulf, and some of the neighbouring islands. It covers about 4,500 km2 and is one of only two parks in the NT that contains adjoining land and marine parks. The park includes the former Gurig National Park (or Cobourg Sanctuary) and	936	956

[24] Note: Some Nature Reserves listed in this table do not appear in Table 7-4, as they were classified as terrestrial reserves. However, they have been included here to highlight important Indigenous cultural heritage values associated with these areas.

Listed Place	Cultural Values	Distance from Activity Area (~km)	Distance from Prelude (~km)
	the Cobourg Marine Park. It protects rare species, including Dugongs and six marine turtle species (Green, Loggerhead, Hawksbill, Olive Ridley, Leatherback and Flatback Turtles). The Traditional Owners of Cobourg Peninsula (the Arrarrkbi) have lived on and used the Peninsula for between 40 000 and 60 000 years. In many Dreamtime stories across the Northern Territory, it is considered that the Creation Ancestors first entered Australia via Malay Bay near the Peninsula before travelling across the rest of the country creating people and places. The Garig Gunak Barlu National Park is managed under a joint management arrangement between the Arrarrkbi people and the Parks and Wildlife Commission of the Northern Territory. This was the first formal joint management arrangement in Australia (DCCEEW 2021).		

Source: DNP 2018 a,b,c

7.10.1.2.4.5 Threats to Country

Through the IPA process and associated Healthy Country Plan framework, Indigenous Peoples have identified specific threats to the health of land and Sea Country. Frequently identified threats include:

- Loss of traditional knowledge and connection to Country. Literature review of Healthy Country Plans suggests that this is one of the biggest threats. Traditional knowledge links the country to its people and conversely the people to their Country.
- Illegal commercial fishing by Australian and foreign fishing vessels, as well as overfishing by recreational and commercial fishers who access areas without permission.
- Lack of culturally appropriate consultation with Indigenous Peoples, particularly in relation to cultural sites and sea resources such as turtle and dugong.
- Climate change and potential changes in sea levels, climatic conditions including rainfall and resulting impacts on Country including land and sea resources, and the integrity of cultural heritage sites.
- Coastal pollution such as general rubbish, oil and fuel spills at sea and marine debris. Coastal pollution is a threat to marine life particularly turtles and marine mammals.
- Lack of land and sea management capacity. Traditional Sea Country is often extensive in size and difficult to reach, hindering stewardship practices.
- Lack of infrastructure to access Country. Without access to Country, it is difficult for elders to effectively pass on traditional knowledge to younger generations.
- Difficulty in gaining permission to access Country, and frequently changing regulations and conditions to access Country.
- Resource extraction activities (e.g. sea mining, oil and gas drilling). Indigenous Peoples are concerned about the potential risks these activities present to marine fauna resources (e.g. fish, turtle and dugong), and risks associated with accidents during operations, as well as potential disturbance of the marine floor during pipeline construction and increased shipping activity.

7.10.1.3 Sea Resource Use Practices

7.10.1.3.1 Customary Sea Resource Use

Indigenous Peoples engage in the customary use of Sea Country proximal to the Planning Area. Access to and customary use of Sea Country is an important part of Indigenous culture, integral to maintaining connection to Country and the health and wellbeing of Indigenous Peoples.

Customary activities undertaken in Sea Country within/adjacent the Planning Area include hunting for food and ceremonial purposes, visiting and maintaining cultural sites, making medicine, engaging in ceremonial

activities, sharing traditional knowledge including passing on important Dreaming stories, and general on-Country recreation shared with family. Many customary rights to land and sea resource use are protected through Native Title and/or are provided for through management plans, such as the right to fish and hunt for Dambimangari people which is provided for under the Lalang-gaddam JMP. Customary activities are also managed in accordance with the cultural protocols of different Indigenous groups.

Examples of customary use within or adjacent the Planning Area include the harvesting of green turtles by the Tiwi people, Dambimangari people (and many other Indigenous People) for food, and the collection of sea turtle eggs. Dugongs are an important food source for many coastal Aboriginal people including the Dambimangari people, Tiwi people, Bardi Jawi people and Mayala people.

Commercial activities have been identified as impacting Traditional Owners' ability to carry out cultural activities in private or fish/hunt/gather resources (DBCA 2022).

7.10.1.3.2 Contemporary Sea Resource Use

Indigenous Peoples engage in a range of different resource use activities in the Sea Country. These activities include commercial fishery and aquacultural activities (Section 7.10.1.3.2.1), cultural based tourism activities (Section 7.10.1.3.2.2) and commercial sea management (Section 7.10.1.3.2.3).

7.10.1.3.2.1 Commercial Fisheries Activities

There are no known aquaculture licences held by Indigenous Peoples or organisations under the *Fish Resources Management Act 1994* (WA) that overlap the Planning Area.

7.10.1.3.2.2 Cultural-based Tourism

Section 7.8 describes the socioeconomic values of tourism within the Planning Area. Areas of Sea Country within/adjacent the Planning Area feature spectacular scenery, diverse wildlife and cultural heritage, all of which provide opportunities for nature-based and cultural-based recreational and tourism activities.

Indigenous People are using or have aspirations to use their IPAs, JMPs for marine parks and land tenure arrangements (Native Title and freehold land tenure) to develop commercial opportunities based around cultural connections and conservation tourism. Existing commercial cultural-based tourism activities operating within or adjacent the Planning Area include expedition cruise boat operations, nature-based on Sea Country guided tours and cultural learning and immersion experiences.

7.10.1.3.2.3 Commercial Sea Management

IPAs can be used by Native Title groups to facilitate environmental management contracts and projects. Both IPAs and JMPs present opportunities for the direct employment of Indigenous Peoples but also the delivery of fee for service management work. WGAC has developed an ongoing partnership with Bush Heritage Australia and tour operators (WGAC n.d.). For example, the Crocodile Islands Rangers and the Garngi Ranger group from Croker Islands are funded to undertake marine debris clean-ups, Sea Country patrols and surveillance operations.

7.10.1.4 Indigenous Peoples Rights and Interests

7.10.1.4.1 Statutory Rights and Interests

Native Title holders are afforded certain rights and title to land and sea. These rights may include the right to camp, hunt and gather on land and sea, rights of access, use and occupation, perform ceremony and protect cultural sites. The various rights granted are different for each Native Title determination. Importantly Native Title holders have the right to be consulted about decision or activities that could affect the enjoyment of Native Title rights and interests.

Native Title holders may be granted exclusive Native Title rights in some areas of a determination, and non-exclusive rights in other areas. Within WA, Native Title rights held over waters seaward of the high-water mark are generally non-exclusive. Native Title determinations that overlap the Planning Area are presented in Table 7-21 and Figure 7-40.

Aboriginal freehold rights are in addition to Native Title rights, exclusive access to closed seas, protection of sacred sites and management of IPAs. Aboriginal Land Councils recognized under ALRA hold the rights to Aboriginal Freehold Land and support Traditional Owners in decisions about their land. Aboriginal people who

hold Aboriginal freehold land have the primary spiritual responsibility for sacred sites on the land and are entitled by culture and tradition to hunt and gather on that land. As Aboriginal freehold land includes the intertidal zone, there are Traditional Owners with rights and interest in Territorial waters that overlap the Planning Area. Traditional Owners have control over who enters their land and intertidal zone and what they do there. The NLC and the TLC issue permits in consultation with Traditional Owners to non-Aboriginal people seeking to access Aboriginal land and waters.

7.10.1.4.1.1 Native Title Governance

The following two Native Title Representative Bodies (NTRB) assist Native Title claimants and holders with interests overlapping the Planning Area:

- Northern Land Council (NLC) (Northern Territory)
- Kimberley Land Council (KLC) (Western Australia).

In proceeding with a Native Title claim, the Native Title claimants are required to have a Prescribed Body Corporate (PBC) to progress the claim. PBCs are responsible for consulting with and obtaining the consent of the potential claimants and provide the point of contact for legal proceedings. Following determination, the PBC generally transitions to being a Registered Native Title Body Corporate (RNTBC). RNTBCs then have the responsibility to manage the determination, including decision making on behalf of the Traditional Owners regarding activities proposed by government, negotiations of royalties, access to land and future acts by other parties on their Country. There are many PBCs and RNTBCs with interests in the Planning Area (Table 7-21).

RNTBCs operate at various levels or capacity and reach. Some are well developed and have access to substantial resources through mining or other royalties. Others are still forming and, in many cases, have delegated many functions to larger Aboriginal corporations. For example, Wanjina Wunggurr Aboriginal Corporation uses KLC for financial management, legal matters and consultations. The NLC in the NT assist a number of RNTBCs and PBCs with human resources, administration, financial management and negotiations.

8 Acceptable Levels of Impact and Risk Activities

The OPGGS (E) Regulations require the titleholder to include an evaluation of all the impacts and risks that determined whether these will be of any 'acceptable' or 'unacceptable' level. To comply with this requirement Shell has determined acceptable levels of impact to the environmental receptors that may credibly be impacted by the activities considered within this EP. Shell's processes for determining the acceptability of risks and impacts is detailed below.

8.1 Considerations in Developing Defined Acceptable Levels of Impact and Risk

Shell has established defined acceptable levels of impacts and risks for the activities considered in this EP relating to all the environmental receptors that were identified as being credibly impacted, or at risk of being impacted. The outcomes of the evaluation of environmental impacts and risks were assessed against these defined acceptable levels to determine if the impacts or risks were acceptable. Shell considered these aspects to establish the acceptable levels of impacts and risks:

- Principles of ESD (Section 8.1.1)
- Other relevant requirements (Section 8.1.2)
- Significant impacts25 to MNES (Section 8.1.3)
- Internal context (Section 8.1.4)
- External context (Section 8.1.5).

8.1.1 Principles of ESD

Shell has considered the principles of ESD to define the acceptable levels of impacts and risks, as defined in Section 3A of the EPBC Act. The principles of ESD are summarised as:

- Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
- The principles of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making
- Improved valuation, pricing and incentive mechanisms should be promoted.

8.1.2 Other Relevant Requirements

Shell considered other relevant requirements that apply to define acceptable levels of impacts and risks including:

- Commonwealth Policy (Section 3.1)
- Commonwealth Legislation (Section 3.2)
- Other Legislation (Table 3-2)
- Standards and Guidelines (Section 3.3)

[25] Significant impacts refer specifically to the levels of impacts defined in the MNES - Significant Impact Guidelines 1.1 (DoE 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. Any subsequent reference in this EP to significant impacts refers to these levels unless stated otherwise.

- International Agreements and Conventions (Section 3.4).
- Significant Impacts to MNES (Section 8.1.3)
- EPBC Management Publications (Section 3.2.1.1)
- Protected Areas (Section 7.3.1).

8.1.3 Significant Impacts to MNES

This EP forms the basis for NOPSEMA's assessment of matters protected under Part 3 of the EPBC Act in Commonwealth waters. Therefore, Shell has given specific attention to define the acceptability of impacts and risks to MNES. Shell used the criteria listed in Table 8-1, which is consistent with the Significant Impact Guidelines 1.1 (DoE 2013), where a potential interaction was identified between the relevant MNES and an aspect of the activity.

Potential impacts and risks to MNES from aspects of the activities were deemed inherently acceptable if:

- the significant impact criteria in relation to the MNES are not anticipated to be exceeded
- the management of the aspect aligns with EPBC management publications from the DCCEEW, including threat abatement plans, recovery plans and conservation advice.

Additionally, the Prelude FLNG project was assessed under the EPBC Act through submission and approval of an Environmental Impact Statement; and a series of conditions were applied to the project as a result of this assessment. These conditions are summarised in Table 3-2 which includes cross-references to the relevant sections within the EP and supporting documentation demonstrating how the requirements have been met.

Table 8-1: MNES Significant Impact Criteria Applied to the Petroleum Activities Considered in this EP

Category	Significant Impact Criteria
Listed Critically Endangered and Endangered Species	An action is likely to have a significant impact on critically endangered or endangered species if there is likelihood that it will: • lead to a long-term decrease in the size of a population • reduce the area of occupancy of the species • fragment an existing population • adversely affect habitat critical to the survival of a species • disrupt the breeding cycle of a population • modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline • result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat • introduce disease that may cause the species to decline, or interfere with the recovery of the species.
Listed Vulnerable Species	An action is likely to have a significant impact on vulnerable species if there is a likelihood that it will: • lead to a long-term decrease in the size of an important population • reduce the area of occupancy of and important population • fragment an existing important population into two or more populations • adversely affect habitat critical to the survival of a species • disrupt the breeding cycle of a population • modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline • result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat • introduce disease that may cause the species to decline, or interfere substantially with the recovery of the species.

Category	Significant Impact Criteria
Listed Migratory Species	An action is likely to have a significant impact on migratory species if there is likelihood that it will: • substantially modify, destroy or isolate an area of important habitat for a migratory species • result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or • seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.
Wetlands of International Importance	An action is likely to have a significant impact on a wetland of international importance if there is likelihood that it will result in: • areas of wetland being destroyed or substantially modified • a substantial and measurable change in the hydrological regime of the wetland • the habitat or lifecycle of native species dependent upon the wetland being seriously affected • a substantial and measurable change in the water quality of the wetland which may adversely impact on the biodiversity, ecological integrity, social amenity or human health, or • an invasive species that is harmful to the ecological character of the wetland being established in the wetland.
Commonwealth Marine Area	An action is likely to have a significant impact on the environment in a Commonwealth Marine Area if there is likelihood that it will: • result in a known or potential pest species becoming established in the Commonwealth marine area • modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity on a Commonwealth marine area results • have a substantial adverse effect on a population of a marine species including its life cycle and spatial distribution • result in a substantial change in air quality or water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health • result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected • have a substantial adverse impact on heritage values of the Commonwealth marine area, including damage or destruction of an historic shipwreck.

8.1.4 Internal Context

Shell considered internal requirements to define acceptable levels of impacts and risks. The internal context included Shell's environment policy, environmental risk management framework, internal standards, procedures, technical guidance material and opinions of internal stakeholders.

Shell's internal impact and risk assessment defined acceptable levels as:

- Residual planned impacts that are ranked as minor or less (i.e. minor, slight, no effect or positive effect) and residual risks for unplanned events ranked light or dark blue, are inherently 'acceptable', if they meet legislative and Shell requirements and the established acceptable levels of impacts and risks.
- Moderate residual impacts, and yellow and red residual risks, are 'acceptable' with appropriate controls in place and if good industry practice can be demonstrated.
- Major and massive residual impacts from planned activities, and massive residual risks from unplanned activities, are 'unacceptable'. The activity (or element of) should not be undertaken as the impact or risk is serious and does not meet the principles of ESD, legal requirements, Shell requirements or regulator and stakeholder expectations. The activity requires further assessment to reduce the risk to an acceptable level.

Table 8-2 summarises the acceptability statements, as correlated to the rankings presented in the environmental impact and risk assessments in Section 9.

Table 8-2: Acceptability Categories

Acceptability Statement	Residual Impact (Planned)	Residual Risk (Unplanned)
Inherently acceptable - Manage for continuous improvement by effectively implementing the HSSE & SP MS	Positive Impact Consequence No Impact Consequence Slight Impact Consequence Minor Impact Consequence	Light Blue Dark Blue
Acceptable with controls - apply the hierarchy of control to reduce the risks to ALARP	Moderate Impact Consequence	Yellow Red
Unacceptable	Major Impact Consequence Massive Impact Consequence	Red - X

8.1.5 External Content

No objections or claims have been raised by relevant persons to date regarding significant impact to MNEs. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4

8.1.5.1 Indigenous Cultural Features and Values Impact Criteria

A key objective for the relevant persons consultation process is to seek information regarding Indigenous cultural heritage features and values that could potentially be exposed to impacts or risks from Shell's activities. An overview of Indigenous cultural heritage features and values within the Planning Area is also provided in Sections 7.9 and 7.10. Shell used the criteria listed in Table 8-3—which reflect the criteria defined by DCCEEW for Indigenous cultural heritage values of National Heritage places in the Significant Impact Guidelines 1.1 (DoE 2013)—where a potential interaction was identified between the Indigenous cultural heritage and an aspect of the activity.

Table 8-3: Acceptability Categories for Indigenous Cultural Heritage Features and Values

Category	Significant Impact Criteria
Indigenous Cultural and Social Values	An action is likely to have a significant impact on Indigenous cultural heritage features or values if there is likelihood that it will: • Restrict or inhibit the continuing use of a cultural or ceremonial site causing its values to notably diminish over time. • Permanently diminish the cultural value of a place for an Indigenous group to which its values relate. • Alter the setting of a place in a manner which is inconsistent with relevant values. • Remove, destroy, damage, or substantially disturb archaeological deposits or cultural artefacts. • Destroy, damage or permanently obscure cultural or ceremonial, artefacts, features, or objects. • Notably diminish the value of a place in demonstrating creative or technical achievement. • Permanently remove, destroy, damage or substantially alter Indigenous built structures.

8.2 Defined Acceptable Levels of Impact and Risk

Table 8-3 summarises the acceptable levels of impacts and risks to environmental receptors from the petroleum activities considered in this EP.

Table 8-4: Summary of Acceptable Levels

Receptor		Acceptable Level of Impact	Justification
Category	**Sub-category**		
Protected Areas	Marine conservation reserves	No impacts to the values of marine parks.	The environmental values within AMPs would only be impacted by a worst-case unplanned incident such as a large-scale hydrocarbon spill. In a regional environmental context, the nearest Marine Park to the Prelude FLNG facility and Activity Area is ~113 km and 94 km away, respectively. Modelling shows a low probability of contact (<5%) at any AMP's contacted at or above the adverse exposure values from a hydrocarbon spill (Table 9-119). Shell considers any large-scale hydrocarbon spill to be unacceptable.
	Wetlands of international and national importance	No impacts to the ecological values of wetlands of international and national importance.	The environmental values within wetlands of international and national importance would only be impacted by a worst-case unplanned incident such as a large-scale hydrocarbon spill. The closest wetland of international and national importance is Ashmore Reef located ~162 km from the Prelude FLNG facility. The oil spill modelling predicts that there is low probability (<5%) of contact from any fate of hydrocarbon at or above the adverse exposure values (Table 9-119). Shell considers any large-scale hydrocarbon spill to be unacceptable.
	Commonwealth and national heritage places	No impacts to Commonwealth or national heritage places values.	The environmental values within Commonwealth or national heritage places values would only be impacted by a worst-case unplanned incident such as a large-scale hydrocarbon spill. The closest Commonwealth and national heritage place is the Ashmore Reef National Nature Reserve is located ~162 km from the Prelude FLNG facility and Scott Reef and Surrounds ~154 km. The oil spill modelling predicts that there is low probability (<5%) of contact by any fate of hydrocarbon at or above the adverse exposure values (Table 9-119). Shell considers any large-scale hydrocarbon spill to be unacceptable.
Physical features, values and sensitivities	Marine regions	No significant impacts to the physical features of a marine region.	The physical features of a marine region would only be impacted by a worst-case unplanned incident such as a large-scale hydrocarbon spill. Shell considers any large-scale hydrocarbon spill to be unacceptable.

Receptor		Acceptable Level of Impact	Justification
Category	**Sub-category**		
	Australian environment	No significant impacts to the Australian environment.	The activity consists of Scope 1 GHG emissions (e.g. flare systems, power generation, venting and fugitive emissions) and Scope 3 GHG emissions (e.g. third-party end users). The GHG emissions from the activity are expected to have a *de minimis* impact on global and Australian carbon budgets and therefore Shell has assessed that there is no impact to the overall consequence level reasonably expected. While there are observed and predicted physical effects of climate change to the Australian environment, such impacts cannot reasonably be attributed to a single activity's GHG emissions Although it is possible to quantify the GHG emissions associated with the Activity (as described in Section 9.12.8.1) it is well-established that GHG emissions rapidly diffuse and commingle in the atmosphere. Further, the GHG emissions arising from the Activity will be *de minimis* in the context of total global and Australian emissions. As such, it is not possible to attribute the physical effects of climate change on Australian environmental values and sensitivities to a particular Activity given such effects arise as a result of cumulative global GHG emissions. Shell recognises that direct emissions must be reduced to ALARP by implementing control measures and achievement of the associated EPO to be acceptable. These emissions will be in accordance with relevant requirements, such as Australian GHG emissions reporting, where required by the NGER Act. Waste that could pose a biosecurity risk will be managed in accordance with relevant regulations, such as the *Biosecurity Act 2015* (Cth) and other requirements (including Annex V of MARPOL). Shell considers any introduction and establishment of pests and diseases to Australian waters as a result of the activity to be unacceptable.
	Air quality	No significant impacts to air quality. Impact not expected to result in a substantial change in air quality, which may adversely	Planned atmospheric emissions from the activity consist primarily of combustion of fuel (e.g. engine exhaust emissions) and hydrocarbons through flare systems, and fugitive emissions. These emissions will be in accordance with relevant requirements, such as MARPOL air pollution requirements.

Receptor		Acceptable Level of Impact	Justification
Category	**Sub-category**		
		impact biodiversity, ecological integrity[26], social amenity or human health.	The activity is located in the open ocean and is well-removed from nearest residential or sensitive populations of the WA coast, with limited interaction with regional airsheds.
	Water quality	No significant impacts to water quality. Impact not expected to result in a substantial change in water quality, which may adversely impact biodiversity, ecological integrity, social amenity or human health.	The area influenced by produced water and other activity discharges is expected to be limited to within 700 m (PC99) for PW and <200m for other liquid discharges of the liquid discharge locations. The potential magnitude of impacts to marine ecosystems is slight. Given the offshore location and absence of particularly sensitive marine ecosystems within the Activity Area potential impacts restricted to 700m for PW and <200 m for other liquid discharges are considered acceptable.
	Sediment quality	No significant impacts to sediment quality. Impact not expected to result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.	Sediment quality within the Activity Area is characteristic of the region. Activity discharges may result in changes in sediment quality in the vicinity of discharge locations. However, accumulation of persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected, is not predicted. This level of impact is considered acceptable.
	Underwater noise	No increase in underwater noise that will have a substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution.	Activity specific noise will not significantly increase underwater noise within the Activity Area. Noise generating activities which may result in behavioural changes within specific marine species, which are limited in nature, scale and duration throughout the activity. This level of impact is considered acceptable.
	Marine bioregions	No significant impacts to benthic habitats and communities.	The benthic and pelagic habitats and communities within the Activity Area are widely represented in the Timor Sea. Given that there are no named banks,

[26] For this EP, a change to ecological integrity is considered to take into account broadscale, long term impacts to the ecosystem. With regards to the Commonwealth marine environment, the Activity Area is located in open offshore waters and the seabed is generally characterised by soft sediments and typical of the region.

Receptor		Acceptable Level of Impact	Justification
Category	**Sub-category**		
Natural features, values and sensitivities		No significant adverse effect on demersal or pelagic communities, populations, habitats or spatial distribution of a species. No substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution. No known or potential pest species become established in the Commonwealth Marine Area.	shoals, reefs or islands located within the Activity Area, direct disturbance to benthic habitats contained within the Activity Area are considered acceptable. acceptable.
	BIAs	No significant impacts to functional values of BIAs. Impacts do not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat that results in an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area.	Impacts to BIAs that do not reduce the functional values of BIAs or adversely affect an important or substantial area of habitat are considered acceptable.
	Critical habitat	No significant impacts to functional values of critical habitat. Impacts do not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat that results in an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area.	Impacts that do not reduce the functional values of Critical Habitats or adversely affect an important or substantial area of habitat are considered acceptable.
	Shoals and banks	No direct impacts to named banks and shoals.	The shoals and banks of the Timor Sea are considered of high environmental value. Shell considers direct impacts to these features unacceptable. No direct or indirect impacts to shoals and banks are expected as a result of the activity, except in the event of a worst-case unplanned incident such as a large-scale hydrocarbon spill. Shell considers any large-scale hydrocarbon spill to be unacceptable.

Receptor		Acceptable Level of Impact	Justification
Category	Sub-category		
		No loss of coral communities at named banks or shoals as a result of indirect/offsite impacts[27]. No known or potential pest species become established in the Commonwealth marine area.	
	Offshore reefs and islands	No impacts to offshore reefs and islands. No known or potential pest species become established in the Commonwealth marine area.	Offshore reefs and islands would only be impacted by a worst-case unplanned incident such as a large-scale hydrocarbon spill. Oil spill modelling predicted that Scott Reef South has the highest likelihood (compared to other regional offshore reefs and islands) of hydrocarbons exposure above adverse impact thresholds. Contact is limited to < 10% probability across offshore reefs and islands at all fates and thresholds at adverse exposure values (Table 9-119). Shell considers any large-scale hydrocarbon spill to be unacceptable.
	Coastal reefs and islands	No impacts to coastal reefs and islands.	Coastal reefs and islands would only be impacted by a worst-case unplanned incident such as a large-scale hydrocarbon spill. Stochastic oil spill modelling shows a low probability of < 10% probability at coastal reefs and islands at all fates and thresholds at adverse exposure values (Table 9-119).
	Key Ecological Features (KEFs)	No significant impact to environmental values of KEFs	There are no KEFs present within the Activity Area; Prelude is located ~17 km from the nearest KEF, the Continental Slope Demersal Fish Communities KEF. Given there are no planned impacts to KEFs from Prelude FLNG, any impacts to KEFs will be below the significant impact threshold. Shell considers any impacts to KEFs below this threshold to be acceptable. Several KEFs may potentially be impacted in the event of a worst-case hydrocarbon spill. From hydrocarbon spill modelling the probability of impact at the adverse exposure value is greatest at Ashmore Reef and Cartier

[27] As defined in the matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DoE 2013).

Receptor		Acceptable Level of Impact	Justification
Category	**Sub-category**		
			Islands and surrounding Commonwealth waters and Continental slope demersal fish communities. Shell considers any large-scale hydrocarbon spill to be unacceptable.
	Threatened migratory marine and cetacean species	No mortality or injury of cetaceans. Management of aspects of the activity must align with conservation advice, recovery plans and threat abatement plans (Table 8-1). No significant impacts to EPBC Act listed threatened, migratory, marine or cetacean species.	Impacts that are below the significant impact thresholds are considered acceptable. Shell considers significant impacts to MNES to be unacceptable. Impacts that are below the significant impact threshold defined are considered as acceptable.
Socioeconomic features, values and sensitivities	People and communities	No significant impacts to people and communities.	The Activity Area is distant from any population centres and the modelling for a worst-case spill scenario does not predict any exposure for people or communities. No impacts are considered acceptable.
	Fishing industry	No negative impacts to targeted fisheries resource stocks that result in demonstrated loss of income for commercial fisheries. Temporary displacement of fishing activities within the Activity Area (excluding PSZs) is acceptable. Permanent exclusion of fishing activities from PSZs is acceptable.	Shell considers impacts or restricted access to targeted fish stocks that measurably reduces the potential revenue for commercial fishers, charter operators or other benefits provided to traditional fishers (intersects the MoU Box) to be unacceptable. In a regional context, commercial, recreational and traditional fishing is typically concentrated mostly in coastal/shallow waters and minimum fishing effort is known to occur within the Activity Area, given its remoteness offshore. Shell considers the displacement of other users (e.g. commercial, recreational and traditional fishers) from relatively small areas of the open ocean environment in the Activity Area to be acceptable and necessary from a safety and security perspective.
	Tourism and recreation	No negative impacts to nature-based tourism resources resulting in demonstrated loss of income.	Shell considers impacts to nature-based tourism resources that measurably reduces the potential revenue for tourism operators to be unacceptable.

Receptor		Acceptable Level of Impact	Justification
Category	**Sub-category**		
		Temporary displacement of tourism activities within the Activity Area (excluding PSZs) is acceptable. Permanent exclusion of tourism activities from PSZs is acceptable.	In a regional context, there are no known tourist attractions or destinations within the Activity Area or surrounding marine waters, however charter vessels may transit the broader regional waters. Shell considers the displacement of other users (e.g. tourism operators) from the Activity Area, which is a relatively small area of the open ocean environment where existing tourism and recreation use is very low, to be acceptable and necessary from a safety and security perspective.
	Defence	Temporary displacement of defence activities within the Activity Area (excluding PSZs) is acceptable. Permanent exclusion of defence activities from PSZs is acceptable.	Shell considers the displacement of other users (e.g. defence vessels and aircraft) from relatively small areas of the open ocean environment within the Activity Area to be acceptable. In a regional context, there are no designated military/defence exercise areas in the Activity Area and surrounds, however there are regional defence exercise areas with large geographic extents.
	Scientific research/restoration	No impacts resulting in abandonment of long-term established scientific research or restoration programs. Temporary displacement of scientific research and restoration within the Activity Area. Permanent displacement of scientific research and restoration within the petroleum safety zone (excluding activity specific programs).	Shell considers the displacement of scientific research and restoration projects from the PSZ, which is a relatively small area of the open ocean environment, to be acceptable. Given the remote location, it is unlikely that any scientific research or restoration programs outside of those commissioned in association with the activity are feasible.
	Oil and gas industry	Temporary displacement/interruption of petroleum exploration activities and operations within the Activity Area (excluding PSZs) is acceptable.	Shell considers the displacement of other users (e.g. petroleum exploration and operations) from relatively small areas of the open ocean environment in the Activity Area to be acceptable. In a regional context, the nearest facility/field to the Prelude FLNG is the Ichthys development which lies approximately 17 km south of the Activity

Receptor		Acceptable Level of Impact	Justification
Category	**Sub-category**		
		Permanent exclusion of petroleum exploration activities from PSZs is acceptable.	Area. Temporary interruption of operations due to an unplanned incident is considered acceptable.
	Indonesian and Timor-Leste coastlines	No impacts to Indonesian or Timor-Leste coastlines are acceptable.	The Planning Area also overlaps international waters of southwest Indonesia and Timor-Leste and, in the event of a worst-case hydrocarbon spill, there is a 2% probability of hydrocarbons reaching International coastlines in the worst case spill scenarios. Shell considers any large-scale hydrocarbon spill to be unacceptable.
Heritage and cultural features, values and sensitivities	Underwater cultural heritage	No damage or destruction to historical shipwrecks and sunken aircraft is acceptable.	Shell considers any disturbance of historical shipwrecks or sunken aircraft to be unacceptable. No known historical shipwrecks or sunken aircraft will be impacted due to the activity
	Traditional Indonesian fishing	No negative impacts to exploited fisheries resource stocks. Temporary displacement of traditional fishing activities within the Activity Area (excluding PSZ) is acceptable. Permanent exclusion of traditional fishing activities from gazetted petroleum exclusion zones is acceptable.	Shell considers the displacement of other users (e.g. traditional Indonesian fishers) from relatively small areas of the open ocean environment in the Activity Area to be acceptable. The fisheries resource stocks of importance for traditional Indonesian fishers would only be impacted by a worst-case unplanned incident such as a large-scale hydrocarbon spill. Shell considers any large-scale hydrocarbon spill to be unacceptable.
	Indigenous cultural connections	No impacts to Indigenous cultural connections.	Consistent with the criteria defined by DCCEEW for Indigenous cultural heritage of National Heritage places, Shell does not accept impacts to cultural heritage features. In August 2023, DAC commented that no impacts from a spill to their sea Country are acceptable.
	Indigenous cultural heritage values	No significant impacts to Indigenous cultural heritage values.	Consistent with the criteria defined by DCCEEW for Indigenous cultural heritage of National Heritage places (see Table 8-3), Shell does not accept significant impacts to cultural values of a place for an Indigenous group to which its values relate. Consistent with the acceptable criteria for the physical and biological environment, Shell recognises that impacts to the environment

Receptor		Acceptable Level of Impact	Justification
Category	Sub-category		
			may also impact cultural values. Shell considers that no significant impact to these values is acceptable.

9 Evaluation of Environmental Impacts and Risks

9.1 Introduction

This section documents the process for evaluating environmental (including socioeconomic and cultural features) impacts and risks and the development of mitigation measures for the Activity.

9.1.1 Risk Assessment Methodology

Shell Group has a standardised Hazards and Effects Management Process (HEMP) by which Shell Group identifies and assesses hazards and implements measures to manage them. This process is consistent with the principles outlined in the Australian Standard AS/NZS ISO 31000:2018 Risk Management and Handbook 203:2012 Managing Environment Related Risk Environmental Risk. The process is summarised in Figure 9-1. The HEMP is a fundamental element of the Shell Group SEAM Framework and is a process that is applied at every phase of projects and operations.

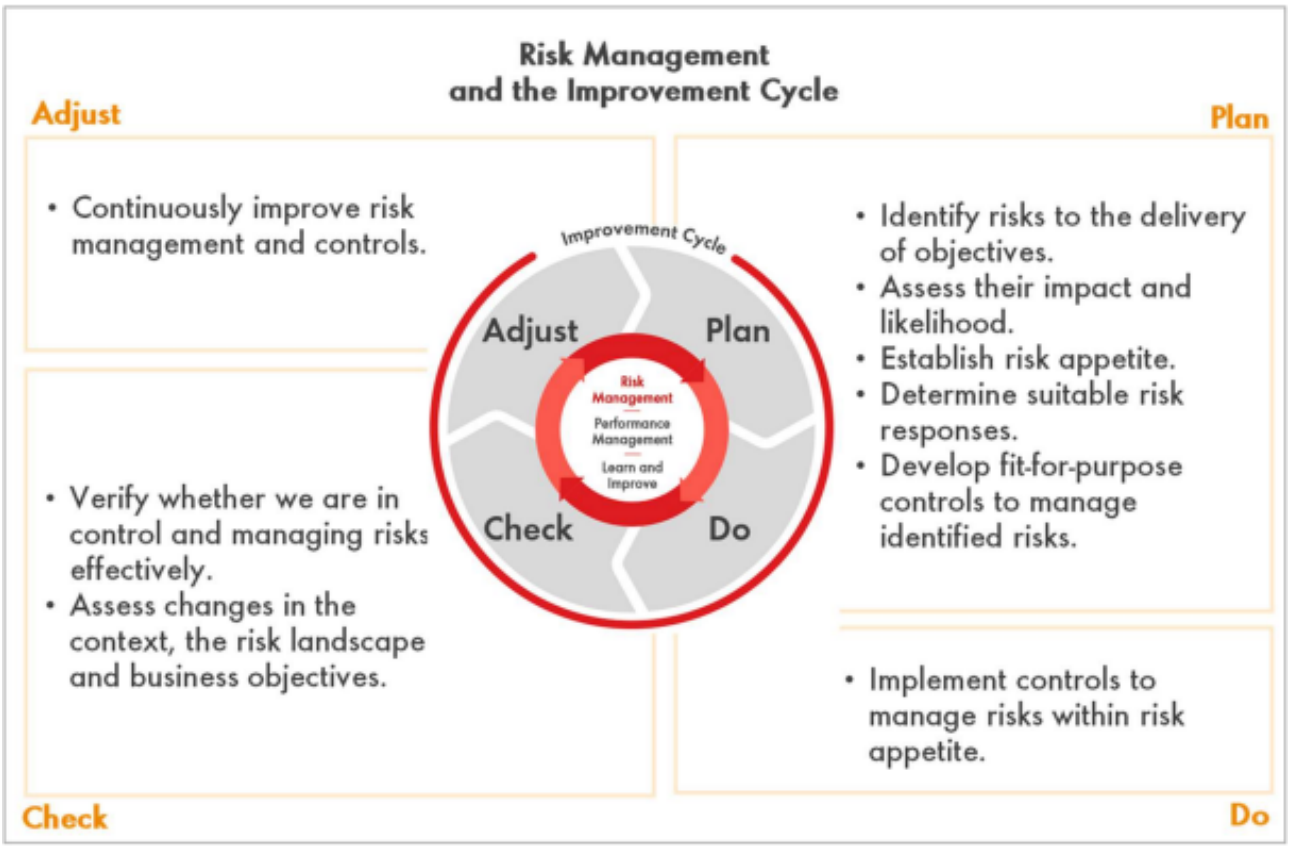


Figure 9-1: Risk Management Framework (Shell Risk Management Practice 2024 v1.1)

Shell's HSSE & SP-MS is continually improving because it incorporates:

- new and amended legislative requirements
- changing community expectations
- improved available technology
- ongoing stakeholder engagement
- learnings from incidents industry wide and within Shell Group
- regular management review.

Shell ensures the HSSE & SP-MS is effective and continuously improving. Shell ensures compliance with new Shell standards through local self-assurance and the ongoing Shell Global auditing process. This process identifies gaps and drives closure of those gaps.

Shell standards are often aligned with, but in many cases more stringent than local legislation, global good industry practice benchmarks such as those published by the International Finance Corporation and World Bank. Both legislation and Shell standards are continually being updated and require a higher level of performance over time. Concurrently, new technologies are becoming available which make improved performance, reliability, and safety possible and more affordable. This continual improvement is reflected in more challenging ALARP and acceptability benchmarks, leading to better environmental outcomes over time.

Section 21(5)(b) of the OPGGS(E) Regulations requires that the EP includes 'an evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk'. This is further clarified by Section 21(6) of the OPGGS(E) Regulations which states that: 'to avoid doubt, the evaluation mentioned in Section 21(5)(b) must evaluate all environmental impacts and risks arising directly or indirectly from (a) all operations of the activity; and (b) potential emergency conditions, whether resulting from accident or any other reason.' Based on this, Shell has chosen to present ALARP demonstrations for all identified impacts and risks, regardless of their ranking.

Section 9.2 details the environmental, socioeconomic, and cultural impacts and risks of the petroleum activities. Activities are described in terms of magnitude/sensitivity and the ranking of planned impacts and unplanned risks. Management actions proposed to reduce any effect on the environment to ALARP are also described.

Various environment professionals carried out a detailed desktop review of the impact and risks assessments when preparing this EP.

9.2 Impact Assessment Methodology

This section describes the approach adopted by Shell for identifying and assessing impacts on the environment as relevant to the activities within the OPGGS Act guidelines (e.g. NOPSEMA 2025). Planned activities give rise to environmental impacts, while unplanned and accidental events pose a risk of environmental impact, if they occur. The risk ranking of environmental impacts resulting from unplanned or accidental events is evaluated by identifying the worst-case credible consequence (without controls) and then assessing the likelihood for the event occurring (with confirmed controls in place).

For planned risks, all receptors identified as potentially affected and/or potentially impacted are carried forward into the description and evaluation of impacts and risks, however only receptors with predicted impacts are assessed for acceptability. Predicted impacts are not credible for unplanned risks, as impact would only occur if the unplanned event happened. To be conservative, unplanned risks carry all potentially affected receptors forward into the acceptability assessment.

The approach aligns with Shell's methodology that enables a balanced assessment of planned impacts and unplanned risks. The methodology ties potential 'Magnitude' of a predicted impact and the 'Receptor Sensitivity' (see Table 9-5). The matrix is used for assessing impacts and consequences for both planned activities and unplanned events.

Table 9-1 defines the key terminology used in this assessment.

Table 9-1: Definition of Key Terminology for Impact Assessment

Term	Definition
Acceptable	The level of impact and risk to the environment that may be considered broadly acceptable regarding all relevant considerations.
Activity	Components or elements of work associated with the project. All activities associated with the project have been considered at a broad level (as outlined in Section 6).
ALARP	The point at which the cost (in time, money and effort) of further Risk or Impact reduction is grossly disproportionate to the risk or Impact reduction achieved

Term	Definition
Aspect	Elements of the proponent's activities or products or services that can interact with the environment. These include planned activities and unplanned (e.g. emergency) events.
Control	A measure which prevents and/or mitigates risk by reducing the overall likelihood of a worst-case credible consequence occurring. Controls include existing controls (i.e. Company management controls or industry standards) or additional controls (i.e. additional measures identified during the risk assessment processes).
Event	One or more occurrences of a particular set of circumstances can have several initiating causes.
Factor	Relevant physical, biological, socio-economic and cultural features of the environment (also referred to as values, sensitivities and/or receptors).
Hazard	A substance, situation, process or activity that can cause harm to the environment.
Impact	Any change to the environment from a planned activity, whether adverse or beneficial, wholly or partially resulting from a proponent's environmental aspects.
Impact Consequence	The outcome of planned activities or unplanned events, which can lead to a range of worst case, credible consequences. A consequence can be certain or uncertain and can have positive or negative effects. Consequences can be expressed qualitatively or quantitatively.
Inherent risk	The potential exposure defined as the plausible worst-case event in the absence of controls.
Likelihood	Description of probability or frequency of a consequence occurring with controls in place.
Residual risk	The level of risk remaining after risk treatment, i.e. application of controls (inclusive of unidentified risk).
Residual Impact	The level of impact remaining after impact treatment, i.e. application of controls (inclusive of unidentified impact).

9.2.1 Aspects and Impact/Risk Identification

An initial screening process examined each aspect (Table 9-2) to identify potential environmental receptors, as listed in Section 9.2.2.3, that may be exposed to associated impacts or risks. The screening process identified the environmental receptors for each aspect associated with the activities covered by this EP before the detailed evaluation was conducted and potential control measures were considered.

Table 9-2: Key Aspects Arising from the Activity

Aspect	EP Section
Physical presence	Section 9.3
Lighting	Section 9.4
Noise	Section 9.5
Seabed disturbance	Section 9.6
Vessel movements	Section 9.7
Introduction of IMS	Section 9.8
Produced water discharge	Section 9.9
Other liquid discharges	Section 9.10
Atmospheric emissions	Section 9.11
GHG emissions	Section 9.12
Unplanned minor releases	Section 9.13

Aspect	EP Section
Emergency events	Section 9.14
Oil spill response strategies	Section 9.15

9.2.2 Evaluation of Impacts

9.2.2.1 Impact Consequence Assessment

The ranking of environmental impact consequence is assessed in terms of:

- magnitude based on the size, extent and duration/frequency of the impact (Section 9.2.2.2)
- sensitivity of the receiving receptors (Section 9.2.2.3).

9.2.2.2 Magnitude

Table 9-3 outlines the levels of magnitude of environmental impacts. The magnitude of an impact or predicted change (as illustrated in Figure 9-2) takes into account:

- nature of the impact and its reversibility
- duration and frequency of an impact
- extent of the change
- potential for cumulative impacts.

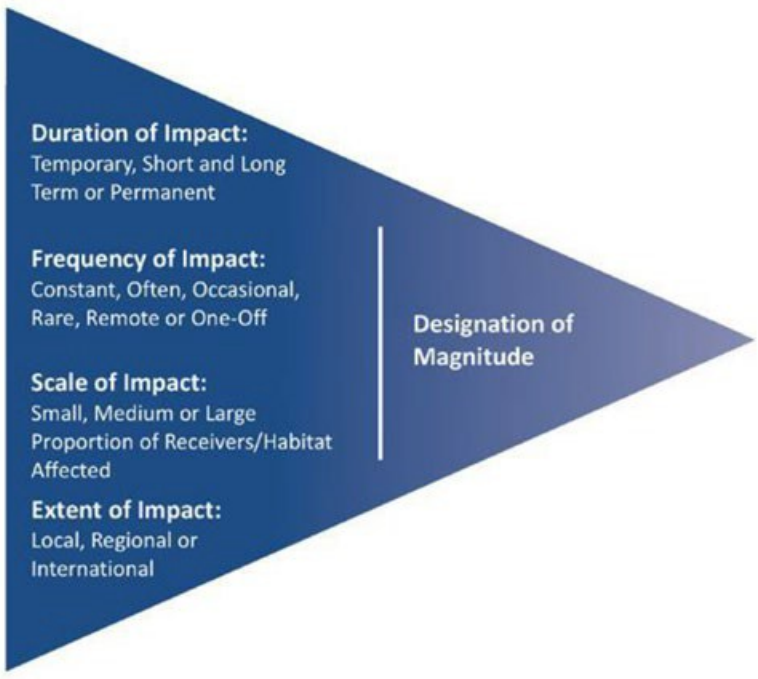


Figure 9-2: Definition of Magnitude in the Context of Impact Identification

Magnitude is defined differently depending on the type of impact—numerals can be used for readily quantifiable impacts (e.g. noise, liquid discharge plume extent), but for others (e.g. communities, habitats) a more qualitative definition applies. The criteria listed in Table 9-3 capture high-level definitions, adapted as appropriate to the offshore context of the Prelude Project.

Table 9-3: Magnitude Criteria

Definition	Environmental Impact
Positive effect	• Net positive effect arising from a proposed aspect of the petroleum activity.

Definition	Environmental Impact
+1	
No effect 0	• No environmental damage or effects.
Slight effect −1	• Slight environmental damage contained within the Activity Area. • Effects unlikely to be discernible or measurable. • No contribution to transboundary or cumulative effects. • Short-term or localised decrease in the availability or quality of a resource, not effecting usage.
Minor effect −2	• Minor environmental damage, no lasting effects (or persistent effects are highly localised). • Minor change in habitats or species. • Unlikely to contribute to transboundary or cumulative effects. • Short-term or localised decrease in the availability or quality of a resource, likely to be noticed by users.
Moderate effect −3	• Moderate environmental damage that will persist or require cleaning up. • Widespread change in habitats or species beyond natural variability. • Observed off-site effects or damage (e.g. fish kill, damaged habitats). • Decrease in the short-term (1–2 years) availability or quality of a resource affecting usage. • Local or regional stakeholders' concerns leading to complaints. • Minor transboundary and cumulative effects.
Major effect −4	• Severe environmental damage that will require extensive measures to restore beneficial uses of the environment. • Widespread degradation to the quality or availability of habitats and/or wildlife requiring significant long-term restoration effort. • Major oil spill over a wide area leading to campaigns and major stakeholders' concerns. • Transboundary effects or major contribution to cumulative effects. • Mid-term (2–5 years) decrease in the availability or quality of a resource affecting usage. • National stakeholders' concern leading to campaigns affecting Shell's reputation.
Massive effect −5 (to be used only for unplanned events)	• Persistent severe environmental damage resulting in loss of use or loss of natural resources over a wide area. • Widespread long-term degradation (not readily rectified) to the quality or availability of habitats. • Major impact on the conservation objectives of internationally/nationally protected sites. • Major transboundary or cumulative effects. • Long-term (>5 years) decrease in the availability or quality of a resource affecting usage. • International public concern.

9.2.2.3 Receptor Sensitivity

For this EP, receptors are grouped into these primary categories (described and subcategorised further in Section 7):

- Protected Areas[28]
- Physical Features

[28] Impacts and risks to the Commonwealth Marine Area are evaluated via assessment of impacts and risks to its constituent physical, natural and cultural heritage values from each aspect of the Activity, and compared to the EPBC Act significant impact criteria for the Commonwealth Marine Area to determine acceptability.

- Physical Values and Sensitivities
- Natural Features
- Natural Values and Sensitivities
- Socioeconomic Features
- Socioeconomic Values and Sensitivities
- Heritage and Cultural Features
- Heritage and Cultural Values and Sensitivities.

Receptor sensitivity criteria are based on these key factors:

- Importance of the receptor at local, national or international level

  For example, a receptor will be of high importance at international level if it is categorised as a designated protected area (e.g. a Ramsar site). Areas that may potentially contain high value habitats are of medium importance if their presence/extent have not yet been confirmed.

- Sensitivity/vulnerability of a receptor and its ability to recovery

  For Example, certain species can adapt to changes easily or recover from an impact within a short period of time. Thus, as part of the receptor sensitivity criteria (Table 9-4) recovery time of a receptor from identified impacts is considered. as well as if the receptor was already under stress.

- Sensitivity of the receptor to certain impacts

  For example, flaring emissions will potentially cause air quality impacts and do not affect other receptors (e.g. seabed).

Table 9-4: Receptor Sensitivity Criteria

Sensitivity	Environmental Impact
Low (L)	• Receptor with *low* value or importance (e.g. habitat or species is abundant and not of conservation significance, exhibits immediate to short-term recovery, and/or easily adapts to change).
Medium (M)	• Receptor of *medium* importance (e.g. recognised as an area/species of potential conservation significance, such as KEF or listed threatened species), or • Recovery likely within 1–2 years following cessation of activities, or localised medium-term degradation with recovery in 2–5 years.
High (H)	• Receptor of *high* importance (e.g. recognised as an area/species of potential conservation significance with development restrictions, such as marine parks or conservation reserves, or habitat critical to the survival of a species), or • Recovery not expected for an extended period (>5 years following cessation of activity) or cannot be readily rectified.

9.2.2.4 Impact Consequence Ranking

The magnitude of the impact and sensitivity of receptor are combined to determine the impact consequence ranking (see Table 9-5). Key management controls are subsequently identified to reduce the magnitude for such an event occurring in order to determine the final residual impact ranking.

Table 9-5: Impact Consequence Ranking Matrix

Magnitude	Sensitivity L	Sensitivity M	Sensitivity H
+1			
0			
-1			
-2			
-3			
-4			
-5			

Residual Impact Consequence Ranking	Residual Impact Acceptability Categories
Positive Impact Consequence	Inherently acceptable - Manage for continuous improvement through effective implementation of the HSSE and SP management system
No Impact Consequence	
Slight Impact Consequence	
Minor Impact Consequence	
Moderate Impact Consequence	Acceptable with controls - Apply the hierarchy of control to reduce the risks to ALARP
Major Impact Consequence	Unacceptable
Massive Impact Consequence	

9.2.3 Evaluation of Risks (Addition of Likelihood Criteria)

To determine the risk ranking of unplanned/emergency events, the likelihood of such an event occurring must be assessed along with the impact consequence. For example, based on magnitude and sensitivity alone, a hydrocarbon spill associated with a loss of well control to surface would be classed as having a major impact consequence, however, the inherent likelihood of such an event occurring would typically be in the range of unlikely to remote. In addition, the mitigation measures for such impacts focus on reducing the likelihood of the well head failing not reducing the magnitude of the impact itself. Thus, unplanned must be assessed in terms of residual risk.

As with planned activities, the potential impacts of unplanned events are identified, and the impact consequence ranking is determined – this considers the magnitude of the event and sensitivity of the relevant receptor(s). The residual impact consequence ranking is then combined with the likelihood of the event occurring (Table 9-6) to determine the overall environmental risk ranking (using Table 9-7). To determine residual risk, controls are then identified to reduce the risk of such an event occurring.

Table 9-6: Likelihood Criteria

A	• Never heard of in the industry – **extremely remote**. • <10^{-5} per year. • Has never occurred within the industry or similar industry but theoretically possible.
B	• Heard of in the industry – **remote.** • 10^{-5}–10^{-3} per year. • Similar event has occurred somewhere in the industry or similar industry but not likely to occur with current practices and procedures.
C	• Has happened in the Shell Group or more than once per year in the industry – **unlikely**. • 10^{-3}–10^{-2} per year. • Event could occur within the lifetime of similar facilities; has occurred at similar facilities.
D	• Has happened at the location or more than once per year in the Shell Group – **possible**. • 10^{-2}–10^{-1} per year. • Could occur within the lifetime of the development.
E	• Has happened more than once per year at the location – **likely**. • 10^{-1} – >1 per year. • Event likely to occur more than once at the facility.

Table 9-7: Environmental Risk Matrix (Unplanned Events)

Residual Impact Consequence	Likelihood A	B	C	D	E
No Impact Consequence					
Slight Impact Consequence					
Minor Impact Consequence					
Moderate Impact Consequence					
Major Impact Consequence					
Massive Impact Consequence			X	X	X

	Residual Risk Acceptability Categories
Light Blue	Inherently Acceptable - Manage for continuous improvement through effective implementation of the HSSE and SP management system
Dark Blue	
Yellow	Acceptable with Controls - Apply the hierarchy of control to reduce the risks to ALARP
Red	
Red - X	Unacceptable

9.2.4 Assessment of Residual Impacts and Risks

The risk assessment methodology applied ensured the following key steps were completed throughout scenario development:

1. Hazards identified
2. Initiating causes determined
3. Worst case credible scenarios agreed (without controls in place)
4. Release of hazards understood (i.e. top events)
5. Preventative controls listed
6. Mitigative controls listed
7. Likelihood determined (with confirmed controls in place)
8. Risk ranking attributed.

When evaluating residual impacts and risks (see Table 9-5 and Table 9-7), Shell assumed all controls were implemented effectively and functioning as intended.

The residual rankings displayed in the summary tables in each subsection represent the highest residual impact or risk (where relevant) for each primary receptor category (i.e. physical environment, biological environment, and socioeconomic values and sensitivities) and therefore are considered a conservative assessment for individual environmental values/sensitivities. These residual rankings were then compared to the acceptability categories outlined in Section 8 to determine a final ALARP and acceptability statement.

Cumulative environmental impacts and risks are also considered and discussed, where relevant, through the impact and risk assessment process and consider current and foreseeable pressures on the environment (e.g. other petroleum activities, other marine industries and users, other ecosystem pressures).

9.2.5 ALARP Assessment

For Shell, ALARP means the point at which the cost (in time, money and effort) of further risk or impact reduction is grossly disproportionate to the risk or impact reduction achieved.

ALARP can be demonstrated using various mechanisms:

- quantitative methods, such as via technical assessments (e.g. modelling studies) or where the costs of the various options can be compared with the respective impact/risk reduction
- semi-quantitative methods, where impacts/risks within a certain level require a pre-defined number of barriers of a certain effectiveness in place to prevent this hazard being released
- qualitative analysis, where ALARP is established using standards, legislative requirements and judgement based on experience.

Shell applies a hierarchy of control process to demonstrate ALARP, as shown in Figure 9-3.

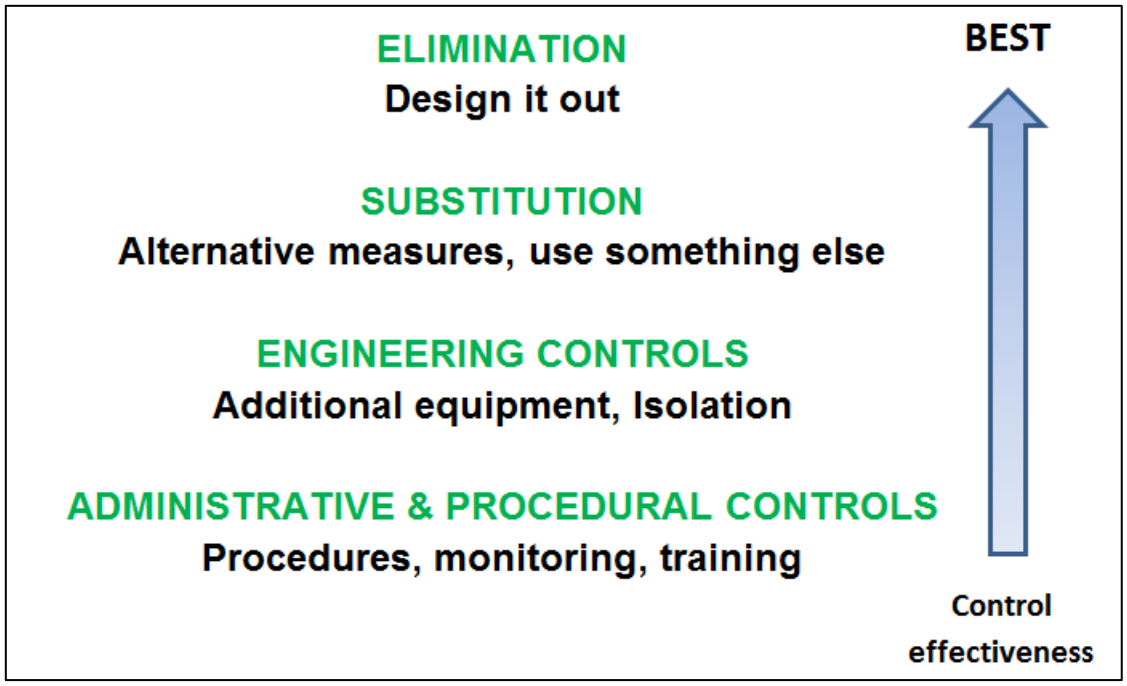


Figure 9-3: Hierarchy of Controls

9.2.6 Environmental Performance Outcomes and Environmental Performance Standards

Environmental Performance Outcomes (EPOs) have been developed for all aspects of the activity. The purpose of the EPOs is to provide specific, measurable levels of environmental performance that are:

- consistent with the principles of ESD
- demonstrate that the environmental impacts and risks are of an acceptable level.

Note that the consideration of acceptability for each aspect is provided in the relevant **Acceptability** sections in the evaluation of environmental impacts and risks. Consequently, these acceptability considerations are a component of the EPO.

EPOs associated with planned impacts will generally be demonstrated through successful implementation of controls, environmental performance standards and associated measurement criteria. Note that controls may include environmental monitoring programs, however these are not required where there is high confidence in the effectiveness of controls and the potential for environmental impact is low. Where an unplanned event (e.g. accidental discharge) results in the potential for environmental harm, the incident reporting and investigation process will identify if there is the potential for environmental impacts. This process will provide sufficient information to determine if the EPO has been achieved.

Environmental Performance Standards (EPSs) and associated Measurement Criteria (MC) that include references to specific sections of the EP are provided solely for the convenience of the reader. These references are intended to facilitate ease of understanding and navigation. It is important to note that these references are not part of the EPS or MC itself, and the referenced information does not form part of the EPS or MC itself.

9.3 Physical Presence

9.3.1 Aspect Context

The physical presence of the activity infrastructure, notably the Prelude FLNG Facility and associated subsea infrastructure, will provide hard substrate within an area that is predominantly soft sediments. Over time, this is likely to be subject to colonisation and growth of encrusting organisms and encourage the development of more diverse marine communities.

The physical presence of infrastructure and support vessels also has the potential to displace other marine users from the Activity Area. A permanent PSZ of 1500 m has been established and gazetted around the FLNG mooring chain touchdown locations and well centre (DC-1P), as per the OPGGS Act (NOPSEMA 2015), from which unauthorised marine users are prohibited from entering. The PSZ is a key safety measure to reduce potential interactions with the FLNG facility and associated subsea infrastructure.

Outside of the PSZs, there may be temporary displacement due to the presence of vessels. This displacement could affect activities and access to areas associated with fishing, tourism and recreation, defence, commercial shipping and other oil and gas activities within the region. The potential for impact, however, is limited due to the restricted size of the PSZs compared to the area available for transit, the expected low number of vessels operating during the scope of this activity and the low level of third-party use of the area.

9.3.2 Description and Evaluation of Impacts

Table 9-8 indicates the environmental features and values and sensitivities that have been identified to be potentially affected by physical presence during the Activities covered by this EP, with further evaluation of the impacts and/or risks to each potentially affected receptor category (including cumulative impacts) provided in Sections 9.3.2.1 to 9.3.2.3. Features or values and sensitivities which could not be credibly affected are not discussed further.

Table 9-8: Physical Presence Receptor Impact Screening Summary

	Protected Areas			Features															Values and Sensitivities																									
				Physical		Natural				Socioeconomic							Heritage and Cultural			Physical				Natural									Socioeconomic								Heritage and Cultural		
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened and Migratory Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect									×		×																				×											

Legend:		
		Potentially affected
	×	Predicted impact

9.3.2.1 Natural Features, Values and Sensitivities

9.3.2.1.1 Timor Province Bioregion

The seabed within the Activity Area is predominately bare and unconsolidated sediment, which supports relatively low diversity and abundance of marine communities. The physical presence of the Prelude FLNG and associated subsea infrastructure provides a substrate for the attachment of organisms such as sponges and gorgonians. The resulting habitat will be relatively complex compared to much of the pre-existing habitat and will serve as an artificial reef. Recent survey work on the North West Shelf has highlighted the increased fish species richness and abundance associated with offshore oil and gas infrastructure, and subsea pipelines (Bond et al. 2018; McLean et al. 2017). Although localised, the expected change in benthic and demersal communities, including a likely increase in fish diversity and abundance, is considered to be a positive impact (Magnitude: +1, Sensitivity: L).

9.3.2.2 Socio-Economic Features, Values and Sensitivities

9.3.2.2.1 Fishing Industry

Three managed fisheries (one Commonwealth–managed and two WA–managed) have the potential to interact with Prelude infrastructure and/or vessels/equipment within the Activity Area. Potential impacts of physical presence include minor interference (navigational hazard), localised displacement/avoidance by commercial fishing vessels, damage or loss of fishing equipment, and loss of commercial fish catches within the immediate vicinity of the infrastructure.

However, such interaction is considered unlikely because:

- low fishing effort occurs within the Activity Area (Table 7-20)
- restricted access due to the activity is small compared to the fishing licence area available for their use (Section 7.8)
- fishers are aware of and avoid the existing PSZ locations.

The seabed within the Activity Area is predominately bare and unconsolidated sediment, which supports relatively low diversity and low abundance fish assemblages compared to more complex habitats (e.g. reefs and shoals). Fishers traversing the Activity Area may have to make minor navigational adjustments to avoid infrastructure or vessels but significant disruption to these fishers is considered unlikely, given the remote location and size of the PSZs and the water depths in the Activity Area. As described in Section 9.3.2.1, the hard substrate provided by the infrastructure will encourage the development of more abundant and diverse attached communities, providing a localised increase in habitat for fish and invertebrates. Recent survey work on the North West Shelf noted that the fish assemblages associated with subsea infrastructure tended to have a relatively high portion of commercially targeted fish species that preferred complex habitats (Bond et al. 2018; McLean et al. 2017). Therefore, it can be expected that the Prelude infrastructure may eventually provide benefits to fishers that offset or partially offset any adverse impacts of physical presence, and overall, this aspect is considered to have low impact on the fishing industry (Magnitude: -1, Sensitivity: L).

9.3.2.2.2 Tourism and Recreation

No known tourism-based activities occur within the Activity Area (see Section 7.8.4). Given the water depths in the Activity Area, the lack of any geographic or UCH features such as shoals, banks, reefs or shipwrecks, and the distance offshore it is unlikely any tourism or recreation activities will occur in or near the Activity Area over the duration of operation. Tourism operators and recreational users may occasionally transit the Activity Area, but any minor navigational adjustments required to avoid activity infrastructure or vessels is expected to have negligible impacts (Magnitude: 0, Sensitivity: L).

9.3.2.2.3 Defence

No designated defence exercise areas or planned activities occur within the Activity Area (Section 7.8.5). Maritime and border force surveillance and enforcement activities may occur within Commonwealth waters in and around the Activity Area but no impacts to these operations are expected as a result of the physical presence of infrastructure or vessels (Magnitude: 0, Sensitivity: L).

9.3.2.2.4 Shipping

Most shipping movements in the vicinity of the Activity Area are associated with offtake tankers and support vessels serving the Crux and Ichthys facilities (Section 7.8.6; Figure 7-35). It is possible that commercial shipping may transit near to Prelude facilities, however, given the distance to shipping channels, Shell expects minimal impacts (Magnitude: 0, Sensitivity: L).

9.3.2.2.5 Oil and Gas Industry

The Activity Area is entirely within the Shell petroleum title licence area. The Crux facility is interconnected to the activity via a pipeline. The next closest permanent petroleum infrastructure are the Ichthys FPSO and Montara FPSO, approximately 20 km south and 188 km north east of the Activity Area, respectively (Section 7.8.8). Exploration activities undertaken by other operators in the region within other permit areas are considered possible. No impacts to non–Shell operated oil and gas activities within the region are expected (Magnitude: 0, Sensitivity: L).

9.3.2.3 Heritage and Cultural Features, Values and Sensitivities

9.3.2.3.1 Traditional Indonesian Fishing

Prelude and its Activity Area lie within the MOU Box within which traditional fishers may operate. The deep open waters in this part of the Activity Area are very unlikely to support traditional fishing activity, and the physical presence of the facility would not affect traditional fishing methods. Therefore, potential effects are limited to a requirement for transiting Indonesian fishing vessels to navigate around any vessels that may be temporarily within the area. With the controls that are proposed to be implemented, adverse impacts to traditional fishing are not anticipated (Magnitude: 0, Sensitivity: L).

9.3.2.4 Cumulative Impacts

On the basis that concurrent activities will occur, the potential for cumulative impacts is acknowledged. The existing Prelude FLNG and Crux Platform/Pipeline PSZs prohibit unauthorised marine users from entering a small area. Any Crux activities conducted within the vicinity of the Prelude FLNG PSZ (e.g. IMR) may further restrict other marine user movements. Due to the low levels of activity by fishers and other marine users (excluding Crux related operations), and the relatively small area affected by combined facilities/activities compared to the area available for other users, the additive or cumulative effects to marine users is considered to be negligible. Therefore, no change to the overall consequence level is expected.

9.3.3 Impact Assessment Summary

Table 9-9: Physical Presence Evaluation of Residual Impacts

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Evaluation – Planned Impacts			
Protected Areas	N/A	N/A	N/A
Physical Features	N/A	N/A	N/A
Physical Values and Sensitivities	N/A	N/A	N/A
Natural Features	+1	L	Positive Impact
Natural Values and Sensitivities	N/A	N/A	N/A
Socioeconomic Features	-1	L	Slight
Socioeconomic Values and Sensitivities	-1	L	Slight
Heritage and Cultural Features	0	L	No Impact
Heritage and Cultural Values and Sensitivities	0	L	No impact

9.3.4 ALARP Assessment and Environmental Performance Standards

Table 9-10: Physical Presence - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	N/A	N/A	The physical presence of Prelude and associated subsea infrastructure and vessels, cannot be eliminated.	N/A	N/A	N/A
Substitution	N/A	N/A	The physical presence of Prelude and associated subsea infrastructure and vessels, cannot be substituted.	N/A	N/A	N/A
Engineering	N/A	N/A	No additional engineering control measures have been identified to reduce the impact from physical presence.	N/A	N/A	N/A
Administrative and Procedural	Infrastructure and PSZ locations communicated to AHO to allow inclusion on maritime charts.	Yes	Inclusion of facilities and PSZ on maritime charts will allow other marine users to navigate accordingly to avoid adverse interactions with the Prelude facility and restricted areas. This procedural control is also consistent with standard industry practice.	1.1	Active PSZ notification and infrastructure locations issued through AHO.	Consultation records show information was provided to AHO.
Administrative and Procedural	For specific vessel-based activities, outside of the PSZ but within the Activity Area, give a minimum of four weeks' notice of commencement of activities to the AHO to enable a 'Notice to Mariners' to be issued.	Yes	Allows notifications to be made to other marine users in the area to minimise disruption to their activities. A 'Notice to Mariners' may be issued by the relevant authority before the activity. Under the *Navigation Act 2012* (Cth), the AHO is also responsible for maintaining and disseminating navigational charts and publications, including providing safety-critical information to mariners (including any change to prohibited/restricted areas, obstructions to surface navigation, etc.) via the Notice to Mariners system. Notice to Mariners can be permanent or temporary notifications. This procedural control is also consistent with the relevant persons consultation outcomes. The benefits outweigh the costs associated with implementing this control and are considered to reduce risks to ALARP. Routine activities undertaken by support vessels to existing offshore infrastructure or facilities do not warrant promulgation of a 'Notice to Mariners'. Similarly, activities occurring within NOPSEMA's gazetted PSZs do not require promulgation of a 'Notice to Mariners'.	1.2	AHO is notified, at least four weeks prior, to enable a 'Notice to Mariners' to be issued before any specific vessel-based activities outside of the PSZ, but within the Activity Area, commence.	Consultation records show sufficient information provided to AHO to generate 'Notice to Mariners' at least four weeks prior to any specific vessel-based activities outside of the PSZ, but within the Activity Area, commencing.

Administrative and Procedural	Vessels equipped and crewed in accordance with Australian maritime requirements; Marine Order 21, Marine Order 27, Marine Order 30 and Marine Order 71.	Yes	The vessels within the Activity Area will adhere to the navigation safety requirements contained within the COLREGS, Chapter 5 of the SOLAS, STCW Convention, the *Navigation Act 2012* (Cth) and any subsequent Marine Orders, which specify standards for crew training and competency, navigation, communication, and safety measures. Implementing this equipment and personnel control is required under the legislative requirements, hence it must be adopted.	1.3	Vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including implementing:
					• Marine Order 21 (Safety and emergency procedures), including:
					  ○ safety measures such as manning and watchkeeping.
					• Marine Order 27 (Safety of navigation and radio equipment), including:
					  ○ radio equipment and communications.
					  ○ navigation safety measures and equipment.
					  ○ danger, urgency and distress signals and messages.
					• Marine Order 30 (Prevention of Collisions), including:
					  ○ lights and signals as applicable to vessel class per COLREGS requirements.
						Marine assurance records demonstrate compliance with navigation safety requirements including:
						• A Minimum Safe Manning Certificate is in place and identifies minimum crew qualifications to meet the STCW Convention requirement.
						• Records of vessel crew STCW Convention qualifications align with the Minimum Safe Manning Certificate (as applicable for vessel size, type and class).
						• A Vessel Cargo Ship Safety Equipment Certificate demonstrates the vessel has lights, shapes and means of making sound signals and distress signals in accordance

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
					• Marine Order 71 (Masters and Deck Officers), including: ○ all master, mate and watchkeeper officer duties undertaken by crew certified as applicable to vessel class per STCW Convention) requirements.	with COLREGS requirements (as applicable for vessel size, type and class). • Records of Shell's marine vessel assurance process (as applicable for vessel size, type and class).

ALARP Demonstration Statement

Based on the impact assessment outcomes and control measures adopted, Shell considers implementing the control measures appropriate to manage the potential impacts associated with activity physical presence. No additional, alternative or improved controls were identified. Therefore, the impacts are considered to be reduced to ALARP.

9.3.5 Acceptability of Impacts

Table 9-11: Acceptability of Impacts – Physical Presence

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Subcategory**			
Natural Features, values and sensitivities	Marine bioregions	No significant impacts to benthic habitats and communities. No significant adverse impact on pelagic communities, populations, habitats, or spatial distribution of a species. No substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution.	Yes	Physical presence of installed subsea infrastructure likely to form additional hard substrate allowing colonisation by fouling communities that over time become habitats of greater complexity than the existing soft sediments that are prevalent in the Activity Area and support localised increases in abundance and diversity of benthic, demersal, and pelagic marine species. Given the localised scale of potential effects, no significant adverse impact on benthic and pelagic communities, populations, habitats, or spatial distribution of a species is expected.
Socioeconomic features, values and sensitivities	Fishing Industry	No negative impacts to targeted fisheries resource stocks that result in demonstrated loss of income for commercial fisheries. Temporary displacement of fishing activities within the Activity Area (excluding PSZs) is acceptable. Permanent exclusion of fishing activities from PSZs is acceptable.	Yes	Area surrounding the Prelude infrastructure supports minimal fishing activity and no negative impacts are predicted for the target species of the fisheries that may operate. Activities that may require other users, including fishers, to avoid an area outside of the PSZ are relatively small scale, infrequent and short-term. Temporary exclusions of other marine users from the Activity Area are considered acceptable and necessary from a safety, security and oil spill prevention (collision) perspective. Permanent exclusion of marine users from gazetted PSZs is acceptable.

The assessment of impacts from physical presence has been determined as a Slight residual worst-case impact consequence (Table 9-9). The acceptability of the potential impacts from physical presence associated with the activity has been considered in the following context.

Principles of ESD

The potential impacts from physical presence are consistent with the principles of ESD because:

- The physical presence aspect does not degrade the biological diversity or ecological integrity of the Commonwealth Marine Area in the Northern Browse Basin.
- Significant impacts to MNES will not occur.
- The health, diversity and productivity of the marine environment will be maintained for future generations.
- The project does not significantly impinge upon the rights of other parties to access environmental resources (e.g. commercial and traditional fishers).
- The precautionary principle has been applied, and studies undertaken where knowledge gaps were identified. This knowledge has been applied during the evaluation of environmental impacts and risks.

Relevant Requirements

Managing the potential impacts from physical presence are consistent with relevant legislative requirements, including:

- Section 6.6 of the OPGGS Act
- Compliance with international maritime conventions, including:
  - STCW Convention
  - SOLAS
  - COLREGS
- Compliance with Australian legislation and requirements, including:
  - Navigation Act 2012 (Cth) and Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth):
    - Marine Order 21 (Safety of Navigation and Emergency Procedures)
    - Marine Order 27 (Radio Equipment)
    - Marine Order 30 (Prevention of Collisions)
    - Marine Order 71 (Masters and Deck Officers).

Matters of National Environmental Significance

Physical presence will not have a significant impact on MNES.

External Context

No objections or claims have been raised by relevant persons to date regarding physical presence. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see Section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4.

Internal Context

Shell has also considered the internal context, including Shell's environmental policy and Environmental, Social and Health Impact Assessment (ESHIA) requirements. The EPOs, and the controls that will be implemented for the activity are consistent with Shell's internal requirements.

Acceptability Summary

The assessment of impacts and risks from physical presence determined the residual impact rankings were Minor or lower (Table 9-9). Shell considers residual impacts or Minor or lower to be inherently acceptable if

they meet legislative and Shell requirements. The acceptability of impacts from physical presence have been considered in the context of:

- the established acceptability criteria
- ESD
- Relevant requirements
- MNES
- External context (i.e. relevant persons claims or objections)
- Internal context (i.e. Shell requirements).

Shell considers the impacts from physical presence associated with the activity to be ALARP and acceptable.

9.3.6 Environmental Performance Outcome

EPO#	EPO	Measurement Criteria
1.1	No adverse interactions between the activity and other marine users within the Activity Area. Displacement of other marine users is restricted to: • temporary displacement within the Activity Area • exclusion from gazetted PSZs	No supported claims reported that demonstrate direct loss of income or other impacts to marine users as a result of undertaking the Activity.

9.4 Lighting

9.4.1 Aspect Context

The Prelude FLNG facility and supporting activities require 24-hour external illumination to meet maritime and operational safety standards. Permanent artificial light emissions are generated from two primary sources:

- Navigational and operational lighting (e.g. walkways, equipment, escape routes, stairways, temporary refuge, helideck, etc) required for safe function of the FLNG facility and supporting vessels
- Flaring activities from the FLNG facility either from the constantly lit pilot light or during unplanned flaring events

Temporary lighting is also associated with the FLNG facility and supporting activities. For example, safe illumination of work areas for temporary activities on the facility (e.g. workovers, well maintenance, major maintenance activities, turnaround or equipment upgrade/replacement/installation activities) may require additional light fittings which may be intrinsic to the equipment and/or involve additional luminaires installed for the duration of the temporary activities. Intermittent vessel activities and Inspection, Maintenance, and Repair (IMR) campaigns being undertaken in the Activity Area are likely to involve 24-hour operations and require lighting on vessels and associated equipment. Additionally, helicopters transit to and from the facility during daylight hours but could operate at night in emergency scenarios. Typically, this lighting is either bright white (i.e. metal halide, halogen, fluorescent) or yellow/red (high-pressure sodium) and is not dissimilar to lighting used for other offshore activities, including fishing and shipping.

The potential for artificial light sources to impact sensitive fauna not only relates to the intensity of light present, but also the wavelengths of light that are emitted. This is because the visual systems and viewing perspectives of fauna differ to those of humans. While the human eye can perceive visible light in the electromagnetic spectrum range of ~380 (i.e. violet) to 780 (i.e. red) nanometres, the eyes of other fauna species are sensitive to different wavelengths of light. Some fauna cannot perceive long-wavelength red light, whereas others can detect light beyond the blue-violet range and into the UV spectrum (CoA 2020a).

The potential impacts of increased levels of artificial light on sensitive fauna are described in several recovery plans and conservation advice, including the Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA 2017b) and the Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015a). The National Light Pollution Guidelines for Wildlife (DCCEEW 2023b) addresses potential impacts from artificial light on EPBC Act listed threatened and migratory species, species that are part of a listed ecological community, and species protected under state or territory legislation for which artificial light has been demonstrated to affect behaviour, survivorship, or reproduction. These guidelines recommend a specific artificial light impact assessment process is undertaken for listed species that are known to be affected by artificial light where important habitat exists within 20 km of a project. This 20 km threshold provides a precautionary limit and is based on observed effects of sky glow on marine turtle hatchlings (demonstrated to occur at 15 to 18 km; Kamrowski et al. 2014; Hodge et al. 2007) and fledgling seabirds grounded in response to artificial light 15 km away (Rodríguez et al. 2014).

Prelude FLNG is located >20 km from any emergent features and known BIAs for marine turtles, seabirds, and migratory shorebirds. However, consistent with Shell's adoption of the precautionary principle and acknowledging the potential for seabirds and migratory shorebirds to fly within a 20 km radius at night and potentially interact with the artificial lighting on the FLNG facility, a detailed assessment of potential lighting impacts has been undertaken and controls implemented to ensure potential impacts from lighting have been reduced to ALARP.

9.4.1.1 Overview of Light Modelling

Nocterra (2025) characterised the sources of light emissions from the Prelude FLNG facility and provided modelling of predicted potential impact on marine turtles at Browse Island. The modelling report determined the extent of light spill and intensity of luminance from the light sources relative to ambient light conditions. The light model output quantified the spatial extent of radiance which was then converted to full moon equivalents (FME) within the orientation field of view (OFOV) through contour modelling to assess the potential extent of visible light. The model outputs in absolute radiance units, representing light equally across the visible spectrum, present a worst-case scenario. The modelling was assessed against Prelude's operational light inventory baseline and three levels of flare intensity:

- Continuous pilot flaring
- Upset event flaring (start-up operational flaring of inlet separator overhead vapour)
- Safety event flaring (depressurization of topside modules and facility blowdown)

The worst-case duration and volume of flaring was applied for the upset and safety flaring events; 1 week and 45 minutes respectively. It is likely that upset event flaring would occur over a duration of <5 days.

Given the closest sensitive receptor is Browse Island, a habitat critical for survival (HCTS) and internesting BIA for green and hawksbill turtles respectively, the contour and panoramic light modelling was conducted focusing on potential impacts to turtles at this location. Light from Prelude may be visible from a further distance, or potentially at greater luminosity, to other wildlife than reported in this study. However, the effects on other wildlife are assessed below as acceptable in that the influence is not considered to have a substantive impact on their risk rankings in relation to light emissions. No additional important habitats (BIAs) were identified in the light extent (as modelled based on turtles) between normal operations and upset flaring. Therefore, as Prelude's operational lighting is constant for safety requirements, and given the infrequent and short-term nature of flaring events, the impact assessment is considered sufficient in assessing the risk of Prelude's light emissions footprint.

9.4.1.2 Contour Modelling

Contour modelling was conducted with an assumed flat topography and completely dark background given the remote location of the Prelude FLNG facility. Thresholds were set in comparison to ambient light conditions (full moon equivalence, FME) and calculated against a set of evenly spaced viewpoints to determine how the brightness of the FLNG facility declined as the distance from the facility increased. As the nearest sensitive receptor to Prelude is a known HCTS for green turtles (*Chelonia mydas*) at Browse Island, an orientational field of view based on the established field of view of turtles (Witherington 1992) was selected to map the contours. Impact levels were subsequently defined from these thresholds to assess the potential for artificial light associated with the Prelude FLNG facility to impact green turtle behaviour at Browse Island (Table 9-12).

The contour modelling predicted that light from normal operations at Prelude would be theoretically visible on the horizon up to approximately 52 km from the facility (1 – 10% OFOV FME). This extended to ~65 km for an upset flare event, and 104 km for a safety blowdown event. The closest island to the facility (Browse Island) is 42 km away, therefore panoramic modelling was undertaken to estimate the visibility of light from this receptor.

Table 9-12: Orientation field-of-view full moon equivalents (OFOV FME) thresholds for likely behavioural impacts to marine turtles.

Impact category	OFOV FME	Preliminary Impact Category Description
N/A	<0.01	Brightness visible to a marine turtle's field-of-view is less than 1% of a full moon.
0	0.01 – 0.1	Brightness visible to a marine turtle's field-of-view is between 1% and 10% of a full moon, behavioural impacts to marine turtles are unlikely.
1	0.1 – 1.0	Brightness visible to a marine turtle's field-of-view is between 10% and 100% of a full moon, behavioural impacts to marine turtles are possible.
2	>1.0	Brightness visible to a marine turtle's field-of-view is greater than 100% of a full moon, behavioural impacts to marine turtles are likely.

Table 9-13: OFOV FME Contour Modelling Results

Impact level	OFOV FME	Distance to Impact Level (km)		
		Continuous Flare	Upset Event Flare	Safety Event Flare
N/A	<0.01	>52.08	>65.31	N/A*
0	0.01 – 0.1	29.78 – 52.08	37.16 – 65.31	>03.74
1	0.1 – 1.0	14.24 – 29.78	18.67 – 37.16	56.45 – 103.74

Impact level	OFOV FME	Distance to Impact Level (km)		
		Continuous Flare	Upset Event Flare	Safety Event Flare
2	>1.0	<14.24	<18.67	<56.45

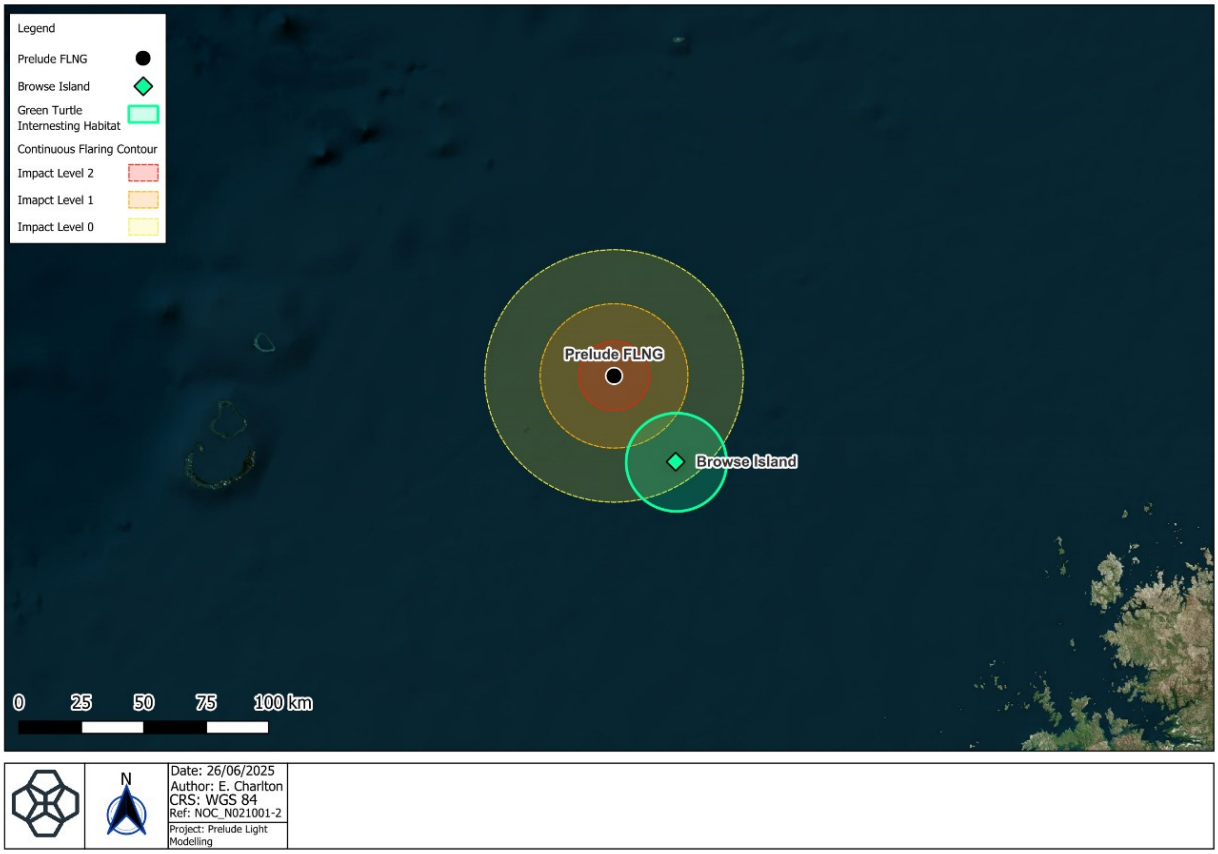


Figure 9-4: Predicted Impact Zones for Contour Modelling

9.4.1.3 Panoramic Modelling

Although the line-of-sight of artificial light may extend tens of kilometres from the source, light intensity rapidly decreases as distance from the light source increases. Panoramic modelling was therefore conducted on the light footprint of the Prelude FLNG facility to predict the light intensity, output as a hemispheric view, at ground level on Browse Island, where critical habitat for green turtles exists. The minimal elevation of topography on Browse Island meant that these results were consistent with the contour modelling. The results, also set in OFOV FME, demonstrated that with the distance of Browse from Prelude, low levels of light influence can be expected from the activity.

Table 9-14: Summary of predicted impact levels on marine turtles from flaring operations

Flare Scenario	OFOV FME	Impact Level for Marine Turtles
Continuous	0.039	0
Upset Event	0.085	0
Safety Event	4.038	2

Visible light from normal operations would be equivalent to 3.9% of a full moon, increasing to 8.5% for an upset event. It is therefore considered unlikely that green turtle nesting activity and hatchling orientation behaviour at Browse Island will be impacted by artificial light from the Prelude FLNG facility under these scenarios.

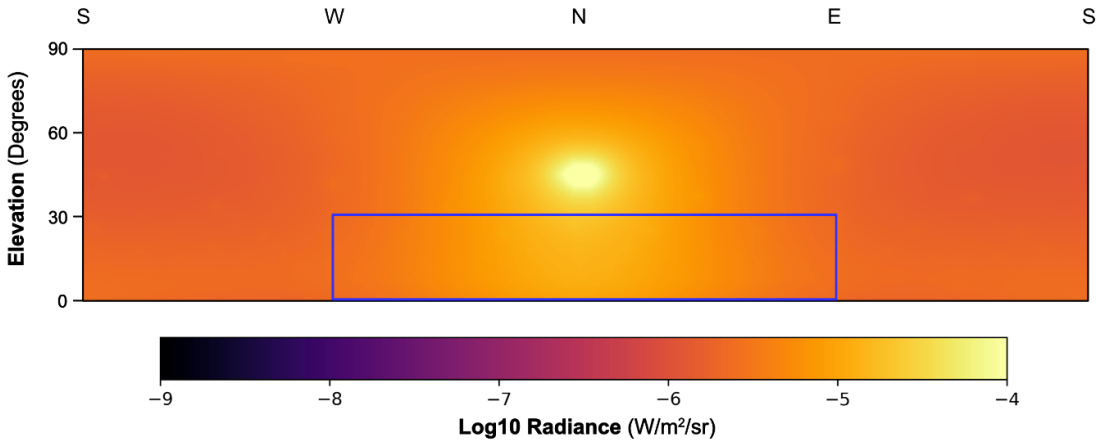


Figure 9-5: Modelled panoramic output of spatial extent of radiance. The turtle field-of-view is pictured as the purple box

In the unlikely event of a safety blowdown, flaring is predicted to result in light levels approximating four times that of the brightness of a full moon (4.038 OFOV FME) at Browse Island, with lower luminosity at Echuca Shoals (62 km) and Heywood Shoals (84 km). A safety blowdown is considered highly unlikely and, if it occurs, is expected to be short-term (45 minutes).

9.4.2 Description and Evaluation of Impacts

Artificial lighting can alter ambient light conditions, which has the potential to affect marine fauna that use light as cues for navigation or behaviour. The impacts of artificial light on these animals may include:

- disorientation, misorientation, attraction or repulsion
- disruption to natural behavioural patterns and cycles
- indirect impacts such as increased predation and reduced fitness.

The Light Assessment Area is defined as a 104 km radius surrounding the Prelude facility. This area encompasses the maximum extent of predicted potential light impact and is used to identify sensitive receptors and inform the lighting impact assessment. The Light Assessment Area is considered conservative, as the predicted spatial extent of light impacts during normal operations from the Prelude facility is limited to a 52 km radius. Under normal operations. Prelude is not expected to have a significant light impact in the greater Light Assessment Area.

Table 9-15 indicates the environmental features and values and sensitivities that have been identified to be potentially affected by the lighting associated with the activities covered by this EP, with further evaluation of the impacts and/or risks to each potentially affected receptor category (including cumulative impacts) provided in Sections 9.4.2.1 to 9.4.2.4. Features or values and sensitivities which could not be credibly affected by activity light emissions are not discussed further.

Table 9-15: Lighting Receptor Impact Screening Summary

Receptor	Protected Areas			Features															Values and Sensitivities																										
				Physical		Natural				Socioeconomic							Heritage and Cultural			Physical				Natural							Socioeconomic								Heritage and Cultural						
	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect									×																					×												

Legend:		
		Potentially affected
	×	Predicted impact

9.4.2.1 Natural Features

9.4.2.1.1 Timor Province Bioregion

Benthic Communities

Light-generating activities are unlikely to impact benthic communities as the Prelude infrastructure is located in waters exceeding 230 m depth (Magnitude: 0, Sensitivity: L).

Pelagic Communities

Pelagic communities in the Light Assessment Area include planktonic communities and pelagic fish and invertebrates. Threatened and migratory species of fish (including sharks and rays) are discussed in Section 9.4.2.2.5.

Fish and zooplankton may be directly or indirectly attracted to lights. Light can alter the daily vertical migration patterns of zooplankton and/or associated predation by other marine species. Experiments using light traps have found that some fish and zooplankton species are attracted to light sources (Meekan et al. 2001), with traps drawing catches from up to 90 m (Milicich et al. 1992). Lindquist et al. (2005) concluded from a study of larval fish populations around an oil and gas platform in the Gulf of Mexico that an enhanced abundance of clupeids (herring and sardines) and engraulids (anchovies), both of which are highly photopositive, was caused by light fields emanating from platforms.

Marine predators are known to aggregate at the edges of artificial light halos where the concentration of marine organisms attracted to light (and potentially the light intensity) increases the food source for these predatory species. Shaw et al. (2002), in a similar light trap study, noted that juvenile tunas (Scombridae) and jacks (Carangidae), which are highly predatory, may have preyed on concentrations of zooplankton attracted to platforms' light fields. This behaviour could potentially lead to increased predation rates in lit areas compared to unlit areas.

The closest known fish aggregation site is Echuca Shoals, located approximately 62 km from Prelude. Light modelling indicates that significant (impact level 1 or 2) changes to prevailing light conditions at Echuca Shoals from activities at the facility would be limited to safety flaring events, which are expected to be highly infrequent and short-term (45 minutes). Therefore, it is considered unlikely that artificial lighting will adversely affect fish at aggregation sites. Fish aggregation may occur within Prelude's vicinity as a result of continuous safe lighting for operations, however given the small impact area surrounding the petroleum activities relative to the extent of zooplankton and fish habitat, any potential impacts would be expected to be highly localised and unlikely to have discernible consequences at a population level. The impact is therefore assessed as Slight (Magnitude: –1, Sensitivity: L).

9.4.2.2 Natural Values and Sensitivities

9.4.2.2.1 Critical Habitats

The closest critical habitat to the Activity Area is the nesting and internesting habitat at Browse Island which are ~42 km and ~22 km south-east of the Prelude FLNG facility at the closest point, respectively. Although artificial lighting from the activity may be visible up to tens of kilometres away from the Prelude facility, the light intensity will typically be low at these locations for turtles (0.039 OFOV FME at Browse in normal operations, and approximately 0.1 OFOV FME in a small Prelude facing portion of internesting habitat around Browse Island) during an upset event (Nocterra 2025). Light levels at Browse are assessed as being unlikely to result in behavioural impacts to marine turtles (Nocterra 2025) under normal operations and during upset events. A small portion (~6 km) of the internesting habitat overlaps with the impact level 1 contour modelled, however given this is on the outer extent of the contour the light intensity is expected to be close to the low FME threshold and unlikely to result in significant impacts. During a safety event, it is considered likely that marine turtle nesting and hatchling orientation behaviour at Browse Island will be impacted by the facility lighting (4.038 OFOV FME). However, given the very low probability of a safety blowdown occurring, and the short-term (45 minute) duration of such an event, this lighting is considered unlikely to significantly impact Browse Island green turtles at a population level (Magnitude: 0, Sensitivity: H).

9.4.2.2.2 Shoals and Banks

Some coral species use moonlight cues to trigger reproductive spawning events; significant light pollution can prevent these corals from detecting moonlight, resulting in their failure to spawn. The nearest Shoals and Banks to Prelude are Echuca (62 km) and Heywood (84 km).

Light modelling (see Section 9.4.1) predicts that the lighting associated with normal activities at Prelude will fall below ambient conditions (0.01 OFOV FME) from a turtle's point of view ~52 km from the facility (Table 9-12). The line-of-sight visibility for coral would not be more than this given the sessile nature of coral and light travelling less within water. Therefore, it is unlikely that coral spawning at nearby shoals or banks would be impacted.

In the unlikely event of a safety blowdown event, flaring would result in light levels (0.1 – 1.0 OFOV FME) up to a full moon at Echuca and Heywood Shoals. However, given the infrequent and short-term nature (45 minutes) of this light reaching these submergent shoals, the shoals are considered unlikely to be impacted. Therefore, no discernible residual impact consequence is expected (Magnitude: 0, Sensitivity: L).

9.4.2.2.3 Offshore Reefs and Islands

The closest reef or island is Browse Island which is located ~42 km from the facility. Some coral present at Browse Island use moonlight cues to trigger reproductive spawning events; significant light pollution can prevent these corals from detecting moonlight, resulting in their failure to spawn In the unlikely event of a safety blowdown, flaring is predicted to result in potential for light to reach Browse island from the facility approximately four times that of the brightness of a full moon (4.038 OFOV FME). However, given the infrequent and short-term nature (45 minutes) of this light reaching Browse Island, no impacts are anticipated. Therefore, no discernible residual impact consequence is expected (Magnitude: 0, Sensitivity: M).

9.4.2.2.4 KEFs

There are no KEFs present within the Activity Area, with the nearest KEF being the Continental slope demersal fish communities KEF, covering a vast area of approximately 33,182 km^2 (see Figure 7-10), located 17 km away in its closest point to Prelude. Given that the values associated with the KEF are at water depths greater than 225 m (upper continental slope) extending down to 1,000 m (mid continental slope) (see Section 7.7.6) they are unlikely to be impacted by light from the activity.

Other KEFs are too distant to be credibly impacted by activity lighting.

Based on the assessment of impacts to fish (Section 9.4.2.1.1), only localised attraction of fish and invertebrates to lighting is expected. Impacts on demersal fish in the water depths associated with the Continental slope demersal fish communities KEF from surface lighting are highly unlikely. Therefore, there is not predicted to be any discernible residual impact consequence (Magnitude: 0, Sensitivity: M) for the KEF values.

9.4.2.2.5 Threatened, Migratory, Marine and Cetacean Species

An EPBC Act protected matters search was undertaken for the Light Assessment Area, as recommended in the National Light Pollution Guidelines for Wildlife (DCCEEW 2023b). This search encompassed the full predicted extent of visible light of Prelude as modelled in Nocterra 2025, which was based on the field of view of a marine turtle. Species identified as potentially occurring within the Light Assessment Area are outlined in Appendix C, and relevant important habitats discussed below.

Marine Mammals

The only marine mammal BIA intersected by the Light Assessment Area is that of the Pygmy Blue Whale (85 km from Prelude). This is well outside of the potential extent of light from normal operations. Threatened and migratory marine mammals that may occur within the Light Assessment Area are predominantly cetaceans (Section 7.7.10). Little is known about the potential impact of artificial light on cetaceans and other marine mammals are not known to be significantly attracted to light sources at sea. Cetaceans predominantly use acoustic senses to survey their environment, rather than visual cues (Simmonds et al. 2004). However, light glow may act as an attractant to light-sensitive prey species (e.g. squid, fish) that may alter predator–prey dynamics, particularly in dolphins. Therefore, a Slight residual impact consequence from lighting on marine mammals is expected (Magnitude: −1, Sensitivity: M).

Marine Reptiles – Turtles

Several EPBC listed marine turtle species (*D. coriacea, C. caretta, L. olivacea, N. depressus, E. imbricata, C. mydas*) are known or likely to occur within the Light Assessment Area. Of these, green turtles (*Chelonia mydas*) are known to nest on habitats including Browse Island (~42 km from Prelude), Cartier Island (~140 km from Prelude), and Sandy Islet (~190 km from Prelude) (CoA 2017b). Browse Island is further assessed as a critical habitat under Section 9.4.2.2.1.

Light can affect the behaviour of adults and hatchling marine turtles. On nesting beaches, light pollution can alter critical nocturnal behaviours in adult and hatchling turtles (CoA 2020). Research suggests that artificial lighting can disrupt or affect the choice of nesting location by female turtles, particularly light visible on the landward side of nesting beaches (Salmon et al. 1992). Turtle hatchlings leaving nesting beaches are particularly sensitive to artificial lighting because they use celestial cues to orientate (Limpus 2008; Salmon et al. 1992) and are attracted towards bright lights. Hatchlings can become disorientated and trapped within light spill around platforms and vessels, resulting in increased energy expenditure, increased predation and decreased survival rates (Witherington and Martin 1996, CoA 2020). However, as hatchlings swim offshore from their natal beach, they become less influenced by light cue and rely predominantly on wave motion, currents and the earth's magnetic field (Lohmann and Lohmann 1992). Individual turtles, including hatchlings, may transit through the Light Assessment Area. At the time of writing, there have been no recorded instances of turtle hatchling sightings around the FLNG.

No other listed critical marine turtle habitat or BIAs occur within the Light Assessment Area. The next closest critical habitat to the Prelude FLNG facility (Ashmore Reef, ~120 km, and green turtle internesting buffer,~121 km, distant) are unlikely to be impacted by light from the activity given the distance from the facility. Considering the panoramic light modelling conducted at Browse Island, and the low numbers of any turtle species likely to occur in the area potentially affected by activity light emissions, there is expected to be a Slight residual impact consequence of light from the activity on hatchling and adult turtles (Magnitude: −1, Sensitivity: M).

Marine Reptiles – Sea snakes

Sea snakes are unlikely to occur in significant numbers in the Activity Area due to the water depths and general absence of preferred habitat types (e.g. shallow reefs, shoals and banks). The three EPBC Act listed threatened species of sea snake that may occur within the Light Assessment Area (Aipysurus fuscus, A. foliosquama and A. apraefrontalis) are all expected to occur in habitats of 0-20 m ((Lukoschek et al. 2013; Udyawer et al. 2020 as cited in DCCEEW 2024h) associated with reefs, shoals and banks. The closest island, shoal or reefs where these sea snakes have been recorded are Scott Reef, Seringapatam Reef, Heywood Shoals and Cartier Reef, located ~149 km, ~140 km, ~84 km and ~140 km from Prelude respectively, as well as the Ashmore and Hibernia reefs (168 and 199 km).

Sea snakes from the Aipysurus genus are not attracted to night lights on vessels (DCCEEW 2024h), however, limited information is available about the impact of artificial lighting on sea snake behaviour more broadly. Artificial light is not identified as a threat in the conservation advice for the dusky sea snake.

Light modelling (see Section 9.4.1) predicts that the lighting associated with normal activities at Prelude would fall below ambient conditions (0.01 OFOV FME) ~52 km from the facility, as perceived by a marine turtle (Table 9-13). The field of view of a sea snake is not likely to be significantly different to that of a turtle given their movement through habitat. It is not credible that normal operational lighting would propagate the additional ~32 km to the closest known sea snake habitat. In the event of a safety blowdown event, the temporarily increased flare could result in light impact at these locations, but the short duration (45 minutes) of such an event would be highly unlikely to impact sea snakes on a population level.

Given the infrequent and temporary nature of low levels of light reaching this submergent shoal, and the very low numbers of individual sea snakes likely to occur in areas affected by lighting in the Activity Area, adverse impacts on sea snakes as a result of lighting is considered unlikely (Magnitude: 0, Sensitivity: M).

Sharks and Rays

The Light Assessment Area was found to overlap with a small portion of a BIA for whale sharks. The BIA is listed as a foraging habitat, however the Conservation Advice (DoE 2015l) for this species indicates this BIA up the northwest coast represents a migration corridor rather than significant foraging habitat. The intersecting

portion of this BIA is unlikely to be impacted by light under normal operations. There is also a high-density foraging BIA along Ningaloo Reef (Figure 124; DoE 2023p), but this is outside of the Light Assessment Area. Whale sharks are known to occur within the Activity Area, with crew onboard Prelude having occasionally observed the species throughout the facility's life cycle, however their presence is transitory and of short duration. This is consistent with tagging studies of whale shark movements that show continual movement of whale sharks in deeper, open offshore waters (Meekan and Radford 2010).

The absence of any other BIAs and/or habitat features that might support aggregations in the Light Assessment Area suggests that the numbers that may be exposed to activity lighting are very low. Species known to occur in the area such as the reef manta ray typically utilise productive nearshore habitats, including island groups, atolls and continental coastlines (Marshall et al. 2022b).

As with other species of fish, light may directly or indirectly affect the behaviours of sharks and rays with 'light pooling' (shining of high intensity lighting directly into the sea) used to attract whale sharks for tourism purposes in some countries (Carroll and Harvey-Carroll 2023). However, given the absence of known BIAs and the oceanic, deep waters within the Light Assessment Area, significant adverse effects on shark or ray behaviours are unlikely.

Threatened or migratory species of sharks or rays are considered unlikely to be impacted by lighting during the activity due to their highly transient nature and low likelihood of encountering elevated light levels. (Magnitude: 0, Sensitivity: M).

Birds

Studies conducted in the North Sea between 1992 and 2002 confirmed that artificial light was the reason that birds were attracted to and accumulated around lit offshore infrastructure (Marquenie et al. 2008) and that lights can attract birds from large catchment areas (Wiese et al. 2001). Birds may be directly attracted by the light source or indirectly—structures in deepwater environments tend to attract marine life at all trophic levels, creating food sources and shelter for birds (Surman 2002). Potential deleterious impacts on birds attracted by artificial lighting can include disorientation, alteration of normal behaviours, and collisions with infrastructure leading to subsequent predation or mortality (CoA 2020).

If migratory birds rely on visual cues (e.g. ambient light, moonlight, starlight) to navigate, in addition to their magnetic compass, then artificial light could alter their natural migratory patterns, particularly in the absence of terrestrial landmarks. Light emissions from offshore platforms in the North Sea have been shown to attract migrating birds, with those that migrate during the night especially affected (Verheijen 1985). During other studies conducted in the North Sea (Marquenie et al. 2008), it was noted that birds travelling within a 5 km radius of illuminated offshore platforms may deviate from their intended route and either circle or land on the platform.

According to Bamford et al. (2008), 33 species of migratory birds that use the East Asian-Australasian Flyway (EAAF) are regularly present in Australia. Migratory shorebird species are mostly present during the non-breeding period, from August through to April each year (DEE 2017b).

Bird injuries and mortalities from direct collisions with infrastructure are inferred from the literature; the collision rate appears to be related to weather conditions, the cross-sectional area of the obstacle, amount of light and number of birds travelling through an area. Where bird collision incidents have been reported, low visibility weather conditions (cloudy, overcast, and foggy nights) have usually been implicated as the major contributing factor (Avery 1976; Elkins 1988; Wiese et al. 2001). Conditions in the Activity Area are not conducive to significant fog formation. However, most rainfall in the Activity Area is seasonal and associated with the summer monsoon and cyclones in November to April, which overlaps with the peak migratory period for birds (see Section 7.7.10.4).

The nearest habitats to Prelude for listed bird species are:

- 57 km to known breeding BIA for greater frigatebird and the red-footed booby.
- 62 km to known breeding BIA for wedge-tailed shearwaters and lesser frigatebirds
- 65 km to known breeding BIA for white-tailed tropicbird.
- 42 km to Browse Island, not a BIA but known habitat for seabirds.

Given the Nocterra (2025) study was focused on modelling light at ground level for marine turtles, light from Prelude may be visible from a further distance or greater luminosity to birds than reported in this study. Birds present at these habitats fly to and from them within the region, including at night, and it is therefore possible that a number of individuals may pass within the area of influence of normal operational lighting whilst in transit and be subject to attraction, disorientation and behavioural disruption. However, the facility may also provide rest, foraging and stop over site selection opportunities.

Since commencement of operations, at the time of writing there have been an average of 11 recorded observations per year of bird sightings on Prelude, of which an average of 7 per year were found deceased. The cause of death could not be confirmed. Some migratory species were observed which is evident given the locality within the EAAF, but none found were listed as Threatened. It is acknowledged that the facility has the effect of attracting a small number of birds resulting in some mortality, however it is not in ecologically significant numbers to impact birds on a regional or population level for any species. Therefore, it is concluded that under the worst-case conditions, there is expected to be a Slight residual impact consequence (Magnitude: −1, Sensitivity: M).

9.4.2.3 Heritage and Cultural Values and Sensitivities

9.4.2.3.1 Indigenous Cultural Heritage

Impacts to fauna from light, including fish and other marine species of potential cultural significance (identified in Sections 7.10.1.2 and 7.10.1.3), are likely to be limited to localised, temporary behavioural effects and unlikely to result in significant impacts to marine species at the individual or population level.

No specific objection, claim or relevant matters were raised during consultation for this EP regarding potential impacts to Indigenous cultural heritage features and values from this aspect. The overall impact consequence is considered to be No Impact (Magnitude: 0, Sensitivity: L).

9.4.2.4 Cumulative Impacts

Light emissions from the activity will result in mostly localised changes to ambient light, unless an upset or safety flaring event occurs. The Activity Area is a significant distance from coastal sources of light emissions, and existing anthropogenic lighting in the region is limited to offshore facilities and shipping traffic. Lighting from vessels supporting Prelude operations are significantly smaller in scale, limited to the 1500 m PSZ and not considered as having a significant cumulative impact.

Light modelling shows that the potential for lighting impacts on sensitive receptors is generally limited to the vicinity of activities and mostly confined to waters surrounding the FLNG location. The proportion of any light sensitive fauna population that might be affected by light emissions from the activity is low and the artificial lighting associated with the activity will generally not increase ambient light levels in areas supporting important behaviours for light sensitive threatened and migratory fauna. The occurrence of a flaring event would substantially increase the extent of visible light in the area; however, their unlikely potential and short-term duration is not considered to significantly impact any receptors on a population level.

Vessel-based IMR activities at Prelude may overlap with lighting from the Prelude facility. However, the potential changes to ambient light associated with these vessels will not extend closer to the important habitats for light sensitive fauna nearest the Prelude FLNG, nor have the intensity to affect light sensitive fauna in those areas, given that vessel lighting is significantly less than that of Prelude and the separation distances of the Prelude FLNG to the nearest sensitive habitats are:

- ~22 km and ~42 km to the Browse Island green turtle internesting buffer and nesting critical habitat.
- ~57 km to the nearest bird breeding BIA.

Light output from vessels in transit to and from Prelude are not within scope of this EP, and light from any vessel activities along the pipeline are assessed under the Crux EP. Due to the absence of significant feeding, breeding, or aggregations of light-sensitive fauna in areas of potential lighting overlap and the very short duration of any concurrent and proximal activities, the additive and cumulative light effects due to the activity can reasonably be expected to be negligible. Therefore, no changes are warranted to the overall consequence level for light impacts from the activity due to cumulative effects.

9.4.3 Impact Assessment Summary

Table 9-16 lists the highest impact consequence rating in the relevant environmental receptor groups.

Table 9-16: Light Emissions Evaluation of Impacts

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Evaluation – Planned Impacts			
Protected Areas	N/A	N/A	N/A
Physical Features	N/A	N/A	N/A
Physical Values and Sensitivities	N/A	N/A	N/A
Natural Features	-1	L	Slight
Natural Values and Sensitivities	-1	M	Slight
Socioeconomic Features	N/A	N/A	N/A
Socioeconomic Values and Sensitivities	N/A	N/A	N/A
Heritage and Cultural Values	N/A	N/A	N/A
Heritage and Cultural Values and Sensitivities	0	L	No Impact

9.4.4 ALARP Assessment and Environmental Performance Standards

Table 9-17: Lighting - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
ALARP Assessment						
Elimination	Eliminate lighting and night activities.	No	Lighting on facility cannot be safely eliminated given the flare system and requirement for navigation safety. 24-hour activities are necessary, therefore, work area lighting and safe illumination from permanent and temporary luminaires will be required and cannot be eliminated. Restricting or eliminating vessel or IMR activities (etc) at night is likely to require vessels to remain stationary on DP, leading to incremental increases in: • GHG emissions. • Discharges and atmospheric pollutants. • Duration. • Project costs. Hence this control is not considered feasible.	N/A	N/A	N/A
Elimination	Eliminate flaring.	No	Occasional flaring is necessary for safe operations. Collection of all flared gas (including pilot and purge) would entail significant cost with the corresponding environmental benefit grossly disproportionate to the additional cost. Flare minimisation is one of the key controls for minimising GHG emissions (see Section 9.12).	N/A	N/A	N/A
Substitution	Retrofitting of the facility topsides with LED lighting.	Yes	At the time of writing, Prelude is assessing the feasibility of retrofitting the facility topsides with LED. A lighting retrofitting project has not yet been approved, however if progressed guidance from the National Light Pollution Guidelines will be considered as a result of the outputs of the light modelling undertaken by Nocterra (2025).	2.1	If retrofitting the facility topsides with LED lighting is undertaken, lighting design choices will consider relevant requirements of the National Lighting Pollution Guidelines with a key objective being to reduce light impacts on MNES if considered ALARP to do so.	Select and detailed phase records demonstrate consideration of the National Lighting Pollution Guidelines.
Engineering	Lighting of the FLNG designed to minimise light spill via: • Shielding • Use low spill/ directional lighting • Use of low-reflective paints • Directing luminaires inwards on the FLNG facility and away from the ocean.	No	The use of low-spill/directional and shielded lighting is not warranted due to the ~42km distance between FLNG and the nearest turtle nesting beach (Browse Island) and the absence of other light-sensitive fauna BIAs around the FLNG location. The above-mentioned LED retrofitting is expected to reduce upward light propagation and therefore reduce skyglow and light spill.	N/A	N/A	N/A
Engineering and Administrative	Optimised operation of the FLNG to maintain safe and reliable operations, maximise production efficiency and	Yes	The GHGEMS, including an GHGEMP, is used to manage significant sources of GHG emissions to ALARP, including unplanned flaring events which may contribute to light emissions	10.6	Net GHG emissions on the Prelude facility are managed to comply with the Safeguard Mechanism and reported annually to the Clean Energy Regulator, as required by the NGER Act.	Public NGER reporting records.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
and Procedural	minimise GHG emissions through: • Reporting of GHG emissions to the Clean Energy Regulator where required by the NGER Act. • Implementation of the Greenhouse Gas and Energy Management System (GHGEMS) as detailed in Section 10.7 including: ○ Greenhouse Gas and Energy Management Plan (GHGEMP). ○ Abatement Workshop and Assessment Process. ○ The Operations Playbook provides guidance to minimise GHG emissions during planned plant shutdowns and start-ups. ○ Methane Emissions Management process and fugitive emissions management procedure.		from the facility. Given its primary purpose is managing GHG emissions, a fuller description of it can be found in Section 9.12. However, the GHGEMS remains an important control measure for reducing unplanned flaring to ALARP and acceptable levels, and therefore, reducing flare related light emissions to ALARP and acceptable levels.	10.7	Prelude will have in place a GHGEMP, which is reviewed annually and includes the following: • An overview of what Prelude's GHG emissions are, and abatement projects being considered • GHG targets and GHG limits • GHG forecast over the life of the Prelude (and Crux when online) field/s • Demonstration of how Prelude manages GHG risk consistent with the GHGEMS (described in Section 10.7) • Methane Improvement Plan	Greenhouse Gas and Energy Management Plan. GHGEMP records demonstrate it is revised annually.
				10.8	An annual abatement workshop is conducted to identify additional emission reduction opportunities. Abatement projects committed to for the year are then managed through the MTO process (described in Section 10.5.14), using the Fit 4 tool.	GHG annual abatement workshop report. Fit 4 records for abatement projects.
				10.9	Prelude facility annual GHG goals and targets (total emissions and abatements) are tracked and managed through the monthly Fuel and Flare Forum.	Fuel and flare forum meeting records.
				10.10	The Operations Playbook directs panel operators on what fuel mode to run the plant on in order to minimise total GHG emissions, depending on which type of trip the facility has experienced.	Records of implementation of the Operations Playbook
Administrative and Procedural	Lighting will be limited to levels required for safe operations and navigational purposes.	Yes	FLNG and vessel lighting will be used as required for safe work conditions and navigational purposes. Safety and maritime regulations require a well-lit work area to support 24-hour operations. As a conservative management measure, vessels working at night within the Activity Area will be required to reduce external lighting to the minimum necessary for safe operations and, where practicable, direct the lighting downwards. Lighting is assessed to only provide necessary lighting for safety and navigation during the Activity. The minimisation of additional lighting and potential light spill reduces the likelihood of potential impacts to transiting fauna to ALARP.	2.2	Lighting will be limited to levels required for safe operations and navigation, with operational lighting directed downward onto the working area where practicable.	Facility and vessel light inspection records.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Administrative and Procedural	Implement vessel light management actions recommended in the National Light Pollution Guidelines for Wildlife (DCCEEW 2023b), including: • switch off outdoor/deck lights when not in use. • use existing block-out blinds on portholes and windows that are not necessary for safety or navigation at night. • manage and report seabird interactions.	No	The specific vessel light management actions recommended in the National Light Pollution Guidelines for Wildlife (DCCEEW 2023b) relate to activities in/adjacent to important habitat and/or important behaviours (such as foraging, reproduction, or dispersal) for light–sensitive fauna. Although these circumstances do not apply to the activity, as a conservative management measure, any vessels working at night within the Activity Area will be required to reduce external lighting to the minimum necessary for safe operations and navigation purposes (refer to EPS 2.2). Given the distance from any known light–sensitive fauna BIA and coastline, the expected low densities of light–sensitive species that may transit the Light Assessment Area, and the lighting assessment predicting minor impacts to these light–sensitive species, the adoption of EPS 2.2 is considered adequate to reduce potential impacts to ALARP.	N/A	N/A	N/A
ALARP Demonstration Statement						
Based on the impact assessment outcomes and control measures adopted, Shell considers implementing the control measures appropriate to manage the potential impacts associated with activity light emissions. No additional, alternative, or improved controls were identified that could further reduce the impacts—beyond negligible environmental benefits if any—without disproportionate effort and cost. Therefore, the impacts are considered to be reduced to ALARP.						

9.4.5 Acceptability of Impacts

Table 9-18: Acceptability of Impacts – Lighting

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Subcategory**			
Natural features, values and sensitivities	Marine bioregions	No significant adverse effect on benthic, pelagic or cetacean communities, populations, habitats, or spatial distribution of a species. No substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution at known natural values and sensitivities	Yes	Light impacts on benthic species surrounding Prelude are not expected given the significant depth of water. Potential impacts in pelagic communities due to behavioural changes and/or indirect effects such as increased predation are limited to the relatively small area illuminated by operational lighting, which is negligible in scale compared to regional population distributions of the biota that may be affected. The low likelihood of a flaring event that would result in light impact on the closest known fish aggregation site means adverse impacts within the Light Assessment Area will be slight.
	Threatened, migratory, marine and cetacean species	No mortality or injury of cetaceans. Management of aspects of the activity must align with conservation advice, recovery plans and threat abatement plans (Table 8-1). No significant impacts to EPBC Act listed threatened, migratory, marine or cetacean species.	Yes	Light impacts on mammal populations in the region are considered unlikely given the only known mammal BIA intersecting the Light Assessment Area falls outside of the extent of normal operational lighting; cetaceans are not known to be significantly attracted to light at sea. Turtles are known to be particularly sensitive to light emissions; modelling at the closest known sensitive receptor/nesting habitat of Browse Island indicates that under normal operational lighting, impacts to turtles are unlikely. Elevated light emissions during a low likelihood flaring event are infrequent, short-term and considered unlikely to impact turtles on a population level. Light emissions are not anticipated to have a significant impact on sea snake species given the lack of sensitive habitat within the Light Assessment Area, hence are consistent with the requirements of the relevant recovery plans. Light emissions are not expected to affect the closest known sea snake habitat under normal operations; the residual impact is considered unlikely.

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	Subcategory			
				The Light Assessment Area intersects a small section of whale shark BIA, only having light impact under an infrequent low probability flaring event. Individual whale sharks may transit the area, but it is considered that there is a negligible risk of impacts to whale sharks on a population level. Sharks or rays may be attracted to light sources and/or to prey attracted to light sources associated with the activity; however, the lack of BIAs and aggregation sites within the Light Assessment Area means that impacts are unlikely. Light from the activity may attract seabirds and migratory birds, which may roost on the facility or become disoriented and collide with infrastructure. Birds may fly between known important habitats within the Light Assessment Area and transit by Prelude, however low numbers of recorded bird sightings throughout Prelude's operational life indicate that light emissions are not expected to result in significant impacts at a population level and residual lighting consequences are expected to be slight. Given this, there are no predicted significant impacts, mortality or injury to threatened, migratory, marine and cetacean species.

The assessment of impacts from light emissions determined a Slight residual worst-case impact (Table 9-16) The acceptability of the potential impacts from light emissions associated with the activity has been considered in the following context.

Principles of ESD

The potential impacts from light emissions are consistent with the principles of ESD because:

- The light emissions aspect does not degrade the biological diversity or ecological integrity of the Commonwealth Marine Area and significant impacts to MNES are not anticipated to occur.
- The precautionary principle has been applied, and studies/reviews undertaken (Nocterra 2025) where knowledge gaps were identified. This knowledge has been applied when evaluating environmental impacts.

Relevant Requirements

Managing the potential impacts from light emissions is consistent with relevant requirements (Table 9-19), including:

- National Light Pollution Guidelines for Wildlife (DCCEEW 2023b).
- policies, strategies, guidelines, conservation advice, and recovery plans for threatened species.

Matters of National Environmental Significance

Threatened and Migratory Species

The evaluation of lighting impacts indicates that no credible significant impacts to threatened and migratory species are predicted to occur from the activity. Table 9-19 demonstrates alignment between the activity and management plans, recovery plans and conservation advice.

Commonwealth Marine Environment

The lighting impacts from the activity are not predicted to exceed any of the significant impact criteria for the Commonwealth Marine Area listed in Table 8-1; as such, it is considered that the aspect does not pose a credible risk to the Commonwealth marine environment.

Table 9-19: Summary of Alignment with Relevant MNES Considerations

MNES	MNES Acceptability Considerations Plans/Recovery Plans/Conservation Advices)	Demonstration of Alignment
Threatened and Migratory Species - Birds	Significant impact criteria for critically endangered, endangered, vulnerable and migratory species (Table 8-1)	The evaluation of environmental impacts indicates that any impacts from artificial light emissions on threatened or migratory species are likely to be slight and would not constitute a significant impact to populations. As such, residual impacts from artificial light associated with the activity do not exceed any of the significant impact criteria for threatened and migratory marine species as listed in Table 8-1.
	Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (CoA 2017c)	
	Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015a)	Managing the light aspect of the activity has been aligned to 'Objective 4' of the Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015a) by ensuring that anthropogenic disturbance was considered in assessment processes. Migratory birds have been considered as an environmental receptor when evaluating lighting impacts.
	National Light Pollution Guidelines for Wildlife (DCCEEW 2023b).	The National Light Pollution Guidelines for Wildlife (DCCEEW 2023b) identifies fauna likely to be affected by artificial light sources and outlines light management actions.

MNES	MNES Acceptability Considerations Plans/Recovery Plans/Conservation Advices)	Demonstration of Alignment
		Shell's proposed light management actions and the impact assessment/thresholds are based on the precautionary limits referenced in these guidelines (Section 9.4.4).
Threatened and Migratory species - Marine Reptiles	Significant impact guidelines for Critically Endangered, Endangered, Vulnerable and Migratory species (Table 8-1)	The evaluation of environmental impacts indicates that any impacts from artificial light emissions on threatened or migratory marine reptiles are slight and would not constitute a significant impact. As such, residual impacts from artificial light associated with the activity do not exceed any of the significant impact criteria for threatened and migratory marine reptile species, as listed in Table 8-1.
	Recovery Plan for Marine Turtles 2017 – 2027 (CoA 2017b)	Light pollution has been identified as a threat in the Recovery Plan for Marine Turtles (CoA 2017b). Nesting females and hatchling turtles are at greatest risk of light impacts; however, the nearest potential nesting habitat is Browse Island (approximately 42 km from the FLNG). Potential light-related impacts to turtles on nesting beaches is considered to be slight. Actions in the Recovery Plan for Marine Turtles (CoA 2017b) relating to the threat of artificial light include: • manage artificial light within or adjacent to habitat critical to the survival of marine turtles such that marine turtles are not displaced from these habitats • develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches • identify the cumulative impacts on turtles from multiple sources of onshore and offshore light pollution Based on light modelling, normal operations on the facility are unlikely to have an impact on turtle population and habitat; impacts under other scenarios (infrequent and short duration flaring) are expected to be slight, therefore the actions listed above are not applicable to the activity.
	National Light Pollution Guidelines for Wildlife (DCCEEW 2023b).	Marine turtles are in the National Light Pollution Guidelines as likely to be affected by artificial light sources. The management of light emissions for the activity has considered the light management actions described in the guidelines and the impact assessment/thresholds have been based on the precautionary limits referenced in the guidelines (Section 9.4.2).
Commonwealth Marine Area	Significant impact guidelines for the Commonwealth marine environment (Table 8-1)	The evaluation of environmental impacts indicates that any impacts from light emissions from the activity are not predicted to exceed the Commonwealth marine environment significant impact criteria as listed in Table 8-1: as such, it is considered that the aspect does not pose a credible risk to the Commonwealth marine environment

External Context

No objections or claims have been raised by relevant persons to date regarding lighting. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see

section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4.

Internal Context

Shell also considered the internal context, including Shell's environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented for the activity are consistent with the outcomes from consultation for the petroleum activity and Shell's internal requirements.

Acceptability Summary

The assessment of impacts and risks from light emissions determined the residual impact ratings were Slight (Table 9-16) given that any visible light (including sky glow) will not displace or disrupt any MNES listed species from important habitat, nor will it prevent these species from being able to undertake critical behaviours such as foraging, reproduction and dispersal. Shell considers residual impacts of minor or lower to be acceptable if they meet legislative and Shell requirements. The acceptability of these impacts have been considered in the context of:

- the established acceptability criteria
- ESD
- relevant requirements
- MNES
- external context (i.e relevant persons claims or objections)
- internal context (i.e. Shell requirements).

Shell considers potential impacts from light emissions associated with the activity to be ALARP and acceptable.

9.4.6 Environmental Performance Outcomes

EPO #	EPO	Measurement Criteria
2.1	No injury or mortality of listed threatened, migratory or cetacean species associated with the Activity.	Reports of injury or mortality of EPBC listed threatened, migratory or cetacean species associated with the Activities sent to NOPSEMA and DCCEEW in accordance with requirements outlined in Table 10-13.

9.5 Noise

9.5.1 Aspect Context

Routine operations of the Prelude FLNG facility will comprise several different acoustic emission sources, primarily associated with power generation and production processes on the FLNG facility, product offtake operations including tanker arrival, loading and departure and infield support and supply vessels. Additional minor sources include sounds associated with aviation, IMR activities and subsea facilities. Generally, sound associated with steady state operations will be minimal, with periodic short-term increases associated with offtakes and vessel operations. These acoustic sources will contribute to and have the potential to exceed ambient noise levels in the region.

Sections 9.5.1.2 and 9.5.1.6 describe key acoustic sources. Sections 9.5.1.7 and 9.5.1.8 summarise the noise impact levels and modelling results.

9.5.1.1 Sound Terminology

Table 9-20 summarises the terminology relevant to the underwater noise impact assessment.

Table 9-20: Sound Terminology

Term	Definition
Auditory injury (AINJ)	Damage to the inner ear that can result in destruction of tissue, such as the loss of cochlear neuron synapses or auditory neuropathy. Auditory injury includes, but is not limited, to permanent threshold shift (PTS).
Peak sound pressure level (PK) or 0-to-peak.	The peak pressure, also called the 0-to-peak pressure, is the range in underwater sound pressure between zero and the greatest pressure of the signal. It is represented by PK and the unit dB re 1 µPa and summarised as dB PK.
Peak-to-peak sound pressure level (PK-PK)	The peak-to-peak pressure is the range in underwater sound pressure between the most negative pressure and the most positive pressure of the signal. It is represented by PK-PK and the unit dB re 1 µPa or dB re 1 μPa^2m^2 and summarised as dB PK-PK.
Permanent threshold shift (PTS)	Permanent loss of hearing sensitivity caused by excessive noise exposure.
Received sound levels	The sound level measured at a receiver.
Root mean square (rms) sound pressure	The root-mean-square pressure is the square root of the average of the square of the underwater sound pressure of the sound signal over a given duration and if applicable, frequency band. It is commonly represented as SPL.
Sound pressure level (SPL)	The level of the time-mean-square underwater sound pressure in a stated frequency band and time window the units are dB re 1 µPa (equivalent to dB re 1 μPa^2) and summarised as dB SPL.
Sound exposure level (SEL)	A measure of the underwater sound energy that considers both received level and duration of exposure. It is the time integrated squared pressure over a given time interval and if applicable, frequency band. The time interval can be a specific duration (e.g. 24 hours) or from the start to end of an event like an airgun pulse, pile strike etc. For this assessment 24 hours has been used for the time interval (e.g. accumulation period) and is shown as SEL_{24h}. Units are dB re 1 μPa^2s or dB re 1 μPa^2m^2s.
Source sound level	The sound pressure level or sound exposure level measured 1 m from a theoretical point source.
Temporary threshold shift (TTS)	Temporary loss of hearing sensitivity caused by excessive noise exposure.

9.5.1.2 Underwater Noise from FLNG Operations

When the FLNG thrusters are not operating, the facility's underwater noise signature is dominated by the noise produced by the utilities (e.g. power generation) and production facilities. These include the steam turbine generators, boilers, air compressors, and pumps located within the hull and topsides process equipment including compressors and motors. Other production related noise contributors include occasional hydrocarbon flaring and continuous acid gas venting.

Machinery noise may be radiated into the underwater environment via the substructure and risers, with noise emitted to the air having limited input to underwater noise levels due to impedance at the sea surface (air/water boundary). The HP and LP flare system generates noise from combustion at the top of the flare tower, which is ~150 m above sea level, modelled at continuous rates of 85–94 dBA (LP flare and ~110 dBA during peak blowdowns, which is predicted to be the largest fixed equipment noise emission source (intermittent and non-routine). However, only a very small fraction of the acoustic energy produced from flaring will transmit through the air/water boundary due to the sea surface acting as a reflective plane and a significant component of the acoustic energy reflecting back into the air.

The highest underwater noise levels will be experienced when the vessel's thrusters are used to maintain position. The requirement to use thrusters is determined by weather conditions but generally occur during the

berthing and de-berthing of the product offtake vessels and on occasions throughout the off-loading period. Thrusters may also be required during supply vessel, helicopter or operations that require a fixed heading.

The alongside offloading configurations for the LNG and LPG carriers may involve the simultaneous operation of thrusters on the FLNG facility, thrusters on three in-field support vessels (acting as tugs), and the main engines of the berthing tanker. Thrusters on the FLNG facility and tugs generate high levels of thrust in poor flow conditions, resulting in significant propeller cavitation and consequent high underwater noise levels.

Predicted noise levels peak in the frequency range 200 Hz to 400 Hz. The corresponding broadband source levels over 10 Hz to 2 kHz are predicted to be 189.1 dB re 1 µPa at 1 m for the FLNG facility, and 189.7 dB re 1 µPa at 1 m for the combined effect of two tugs. If all sources are co-located, their combined source level is estimated at 192.4 dB re 1 µPa at 1 m.

Table 9-21 illustrates the maximum distances from Prelude at which noise levels from normal operations and offtake operations are likely to be exceeded.

Table 9-21: Maximum Distance from FLNG at which the specified received levels are likely to be exceeded

Received Noise Level in 10 Hz to 25 kHz band (dB re 1 µPa)	Cavitation noise during offtake operations	Plant noise during operations
160	80 m	<20 m
150	320 m	<20 m
140	1.4 km	50 m
130	7.25 km	180 m
120	22.9 km	900 m
110	69.2 km	3.29 km
100	30 km	10 km
90	44 km	20 km

9.5.1.3 Underwater Noise from Vessel Operations

The sound levels and frequencies generated by vessels varies with the size of the vessel, speed, engine type and the activity being undertaken. Vessels used for routine operations are detailed in Section 6, and includes DP capable vessels (using bow and stern thrusters which can be a significant source of underwater noise when vessels are in operation). Vessels produce low frequency sound (i.e. below 1 kHz) from the operation of machinery, hydrodynamic flow sound around the hull and from propeller cavitation, which is typically the dominant source of sound.

During normal operations, support vessels will be required to complete routine round-trip voyages between the Activity Area and Darwin or another Australian Port.

Support vessels typically produce sound levels around 160-180dB re 1µPa at 1 m generally dominated by low frequencies during transit and drop with reduced speed. As vessel speed increases, broadband noise such as propeller cavitation and hull vibration noise become dominant over machinery related tones (NRC 2003). When vessels are holding station, frequencies increase considerably with the use of thrusters to maintain position. Based on measurements taken by JASCO of supply vessels similar to those used at Prelude, the expected sound emitted from a supply vessel whilst in DP mode (such as during resupply activities) is a broadband (10 Hz to 25 kHz) source level of 176.7 dB re 1 μPa^2m^2 (Matthews et al. 2022).

9.5.1.4 Underwater Noise from Subsea Infrastructure

The broadband noise produced by an operational wellhead is very low, 113 dB re 1 µPa, only marginally above rough sea condition ambient noise levels (McCauley 2002). To exceed this noise level, multiple wellheads would need to be positioned within a very close proximity of each other (less than ~50 m apart) before their signals combine to increase the total noise field (with two adjacent sources only increasing the total noise field

by 3 dB). Hence for Prelude field wellheads, the broadband noise level in the vicinity of the wellheads would be expected to be of the order of 113 dB re 1 µPa and this would fall to background levels within less than 200 m from the wellhead (McCauley 2002). Similar to wellhead noise, which includes flow noise in pipelines, the noise field produced along a pipeline/flowline may be expected to be very close in levels to that described for wellheads, with the radiated noise field falling to ambient levels within approximately a hundred meters. Within the Activity Area, underwater noise from subsea infrastructure will not have credible potential for significant impacts, therefore noise from subsea infrastructure operations is not discussed further.

9.5.1.5 IMR Activities

Subsea IMR activities are typically undertaken from vessels that use a DP system. This allows manoeuvrability, station keeping and avoids anchoring when undertaking works near subsea infrastructure. As the vessel will maintain its position with the continual use of DP thrusters while undertaking IMR activities, the thrusters will dominate as the source of underwater noise. Noise generated from IMR activities, such as survey and ROV operations, will be non-impulsive intermittent sounds and of short duration. Noise generated from the vessels undertaking the IMR activities will be similar to the noise produced by other marine vessels in the field (e.g. supply boats).

Subsea inspections generally involve the IMR vessel travelling along the route of the subsea system with an ROV to identify or undertake maintenance or repair activities that may be required to ensure the assets are being maintained. Inspection techniques with the potential to generate underwater noise include side-scan sonar. Sonars are used in relatively shallow water depths (70 to 240 m) to detect objects on the sea floor including existing infrastructure and potential seabed hazards, however their use will be occasional only, e.g. once every 1-3 years, and only for several weeks at a time. The sonar operates at high frequencies (typically around 100–500 kHz) with the frequency being dependent on the substrate type, resolution of data required, and water depth.

IMR activities, including use of ROVs and sonar operations undertaken from Prelude or a vessel are thus expected to have minimal contribution to the overall noise emissions associated with the facility or vessel operations, as described in Sections 9.5.1.2 and 9.5.1.3, respectively and are not discussed further.

9.5.1.6 Underwater Noise from Aviation Operations

Helicopters, which are used to transfer personnel, are required from the operating base at Broome, or from Djarindjin (Lombadina) Airport to site. The main acoustic source associated with helicopters is the impulsive noise from the main rotor. Dominant tones in noise spectra from helicopters are generally below 500 Hz (Richardson et al. 1995). The level of underwater sound from helicopters is affected by helicopter altitude, aspect and strength of noise emitted, and the receiver depth, water depth and other variables (Richardson et al. 1995).

The angle at which the line from the aircraft and receiver intersects the water surface is important. In calm conditions, at angles greater than 13° from the vertical, much of the sound is reflected and does not penetrate the water (Richardson et al. 1995). Therefore, strong underwater sounds are detectable for a period roughly corresponding to the time the helicopter is within a 26° cone above the receiver. Richardson (Richardson et al. 1995) reports figures for a Bell 214 helicopter (stated to be one of the noisiest) being audible in air for 4 minutes before it passed over underwater hydrophones, but detectable underwater for only 38 seconds at 3 m depth and 11 seconds at 18 m depth. The maximum received level was 109 dB re 1µPa2. s. Due to their short duration and near surface impacts only, helicopter noise emissions are not considered to be a credible source of noise impact/risk and will not be discussed further.

9.5.1.7 Underwater Noise Impact Levels

Marine species with the greatest sensitivity to underwater noise are marine mammals (whales and dolphins), turtles and fish (including larvae). Other species that could be affected by underwater noise include sea snakes, sharks and rays, and invertebrates.

Impacts to marine fauna can be grouped in the following decreasing order of effect:

- Mortality or potential mortal injury – physical injury that may result in the death of an animal.
- Impairment:

- PTS – a permanent reduction in the ability of an animal to perceive sound. Recovery is not expected to occur.
- Auditory injury – damage to the inner ear that can result in destruction of tissue. Auditory injury may or may not result in PTS.
- TTS – a temporary reduction in the ability of an animal to perceive sound. Recovery to pre-exposure levels is expected to occur.
- Masking – no change in the ability for an animal to perceive sound, but biologically meaningful sounds may be "drowned out" by anthropogenic noise.

- Behavioural impacts – typically short-term behavioural responses such as avoidance, surfacing etc. Behaviour will return to normal following cessation of the anthropogenic noise.

Impact thresholds for the fauna groups for non-impulsive sound sources were derived from scientific literature and published guidelines, including:

- sound exposure guidelines for fish, including fish eggs and larvae (Popper et al. 2014)
- frequency-weighted accumulated sound exposure levels (SEL; LE,24h) from U.S. Navy acoustic and explosive effects analysis (Accomando et al. 2025) for the onset of TTS and PTS in marine mammals and marine turtles
- marine mammal behavioural threshold based on the US National Oceanic and Atmospheric Administration (NMFS 2024) criterion for marine mammals of 120 dB re 1 µPa (SPL; Lp)
- cetacean hearing groupings (Southall et al. 2019)

Consideration of the U.S. Navy Acoustic and Explosive Effects Analysis (Accomando et al. 2025) updates regarding revised marine-mammal behavioural thresholds and cetacean hearing groupings is provided in Sections 9.5.1.7.1 and 9.5.2.4.4.

Table 9-22, Table 9-23 and Table 9-24 summarise the thresholds that could result in PTS, auditory injury, TTS, and behavioural disturbance as a result of continuous and impulsive noise sources for cetaceans, sirenians, turtles and fish.

9.5.1.7.1 Marine Mammals

The vulnerability of marine mammals to underwater noise is linked to their ability to perceive sound. Cetaceans can be grouped based on similarities in their hearing and vocalisation ranges. Underwater noise exposure thresholds can then be weighted for each cetacean group to emphasise noise frequencies that a group may be particularly vulnerable to. This approach is described in Southall et al. (2007) and has been applied to a range of underwater noise guidelines and impact assessments on cetaceans. Southall et al. (2019) updated the nomenclature to describe three cetacean hearing groups as 'Low-frequency' (LF) (e.g. baleen whales), 'High-frequency' (HF) (e.g. dolphins), 'Very high-frequency' (VHF) (e.g. kogia) as well as a separate group for sirenians (dugongs) to better reflect their hearing sensitivities in marine bioacoustics terms. These groupings, along with updated hearing ranges, have been adopted in the 2024 update to technical guidance (NMFS 2024). The US Navy published a revision to their criteria and threshold analysis (Phase 4, Accomando et al. 2025) that suggest the division of LF cetaceans into two groups, very low frequency (VLF) and LF cetaceans. The hearing limit for LF cetaceans was increased to reflect recent hearing measurements in minke whales. Notably, no changes were proposed to TTS or PTS threshold criteria for LF and VLF cetaceans and as such this EP will continue to refer to the two groups collectively as LF cetaceans in relation to potential impacts and risks.

Most of the underwater noise associated with the activity involves continuous (non-impulsive) noise sources, such as vessel noise. Table 9-22 summarises the impact thresholds for continuous underwater noise modelled for cetaceans and sirenians. The thresholds are derived primarily from technical guidelines and exposure criteria published by NMFS (2024), with consideration of the Accomando et al. (2025) threshold updates detailed in Section 9.5.2.4.4.

Table 9-22: Thresholds for PTS, TTS, and Behavioural Response Onset for LF, HF, VHF Cetaceans and Sirenians for Non-Impulsive Noise

Group	PTS onset thresholds: Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	TTS onset thresholds: Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Behavioural response SPL (L_p; dB re 1 µPa)
LF cetaceans	197	177	120
HF cetaceans	201	181	
VHF cetaceans	181	161	
Sirenians	200	180	

9.5.1.7.2 Marine Turtles, Fish and Other Fauna

Table 9-23 summarises the sound exposure guidelines for marine turtles for continuous sounds based on Popper et al. (2014) and Accomando et al. (2025), and Table 9-24 provides similar guidelines for fish. Sharks and rays (including whale sharks) were grouped with fish (no swim bladder) for this assessment of impacts. In accordance with the Conservation Advice for the dusky sea snake (*Aipysurus fuscus*), the dusky sea snake has been grouped with fish with a swim bladder involved with hearing for this assessment of impacts which includes oral gulping fish, also known as physostomous fish. Oral gulping fish have the capacity to gulp or expel air to change the volume of gas in their swim bladder. Being able to expel air in response to loud sounds may reduce the mass of gas and subsequent range of motion of the swim bladder, in turn likely reducing injuries to the swim bladder and surrounding organs (Casper et al. 2013).

There is a paucity of knowledge on noise impacts to sea snakes. A study by Chapuis et al. (2019) demonstrated that *Hydrophis stokesii* (Stokes' sea snake) is sensitive to low frequency sounds, and have relatively low sensitivity compared with bony fishes and marine turtles with a likely peak sensitivity to sound at 60 Hz (163.5 dB re 1 µPa). Conversely, the Conservation Advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW 2024l) suggests that the hearing sensitivity for fish with a swim bladder involved with hearing could be used as a proxy for the dusky sea snake. It is noted that reef-dependent sea snakes, such as the dusky sea snake, have little capacity to relocate to avoid noise. The species is generally confined to their habitat of shallow banks and shoals (DCCEEW 2024l).

Although there are reputable published studies indicating the potential for underwater noise to impact invertebrates, currently there is insufficient evidence for setting interim quantitative impact assessment criteria for these species. No published studies or guidelines on the potential invertebrate response to continuous noise sources have been identified. Invertebrates have not been considered in the assessment of risks and impacts from underwater noise based on these grounds.

Table 9-23: Thresholds for PTS, TTS and Behavioural Response Onset in Marine Turtles for Continuous Noise

Receptor	PTS onset thresholds: Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	TTS onset thresholds: Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Behavioural response
Marine turtles	198	178	(N) High (I) Moderate (F) Low

Source: PTS and TTS thresholds (Accomando et al. 2025), behavioural response threshold (Popper et al. 2014)

Note: The sound units for masking and behavioural effects from continuous noise include relative risk (high, moderate and low) for fish (all types) at three distances from the source defined in relative terms as near (N – tens of metres), intermediate (I – hundreds of metres) and far (F – thousands of metres) (after Popper et al. 2014).

Table 9-24: Thresholds for Continuous Sounds Applicable to Sharks, Rays, Other Fish and Dusky Sea Snakes

Receptor	Mortality and Potential Mortal Injury	Impairment			Behaviour
		Recoverable Injury	TTS	Masking	
Fish: no swim bladder	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder not involved in hearing	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder involving hearing, including sea snakes	(N) Low (I) Low (F) Low	170 dB rms SPL for 48-hours	158 dB rms SPL for 12-hours	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low

Note: The sound units include relative risk (high, moderate, and low) for fish (all types) at three distances from the source defined in relative terms as near (N – tens of metres), intermediate (I – hundreds of metres) and far (F – thousands of metres) (after Popper et al. 2014).

9.5.1.8 Modelling Results vs Threshold Levels

Connell et al. (2025) conducted an underwater noise modelling study for expected noise levels from Prelude FLNG operation and support vessels, including offtake tankers at the Prelude location, to assist in the assessment of potential impacts from noise to marine fauna. The modelling provides a conservative indication of noise propagation associated with these activities. The study specifically assessed distances from operations where underwater sound levels reached thresholds corresponding to behavioural response, impairment (TTS and PTS), and injury (fish only).

The modelling study also provided an acoustic exposure analysis for migrating pygmy blue whales (the only threatened whale species with a BIA that overlaps the Planning Area) using the JASCO Animal Simulation Model Including Noise Exposure (JASMINE) approach, which describes the modelled predictions of sound levels that individual pygmy blue whales may receive during the activities. Given that pygmy blue whales are known to occur outside of the known migratory route and that they have been reported within the Activity Area, unrestricted seeding of animats (simulated animals), which involves animats being randomly placed, or seeded, within the entire simulation area at a specific density, was considered to be the most appropriate approach for the modelled scenarios. Scenarios in which pygmy blue whales are seeded in an unrestricted manner allowed exposure ranges for effect thresholds to be calculated across the entire Activity Area, including any relevant areas beyond that. These ranges may then be interpreted to determine potential zones of effect (such as the noise impact assessment area) for the activity (see Table 7-1 for the Noise Assessment Area). The unrestricted seeding approach is particularly informative for projects that do not intersect the pygmy blue whale BIA, such as this activity. The Prelude FLNG facility is located ~78 km away from the closest known pygmy blue whale migration BIA.

The scenarios modelled in the study (Table 9-25) are considered representative of the sound-producing activities from the operations described in this EP, and included the following sound producing sources:

- machinery noise from Prelude
- thruster noise from Prelude
- vessel noise from 3x ISVs under DP
- vessel noise from a PSV conducting resupply operations under dynamic positioning (DP).

Table 9-25: Description of modelled scenarios

Scenario	Operation	Operation Description
1	FLNG Operations	Standalone FLNG facility machinery noise (no thrusters)
2	Offtake	FLNG with thrusters and machinery noise Berthing (tanker + 3 x ISVs on DP) Loading (3 x ISVs no DP)
3	Material Resupply	FLNG with thrusters and machinery noise 1 x PSV on DP

The most conservative scenario (Scenario 2) was evaluated in this assessment. Modelling of this combined scenario showed (see Table 9-26 and Table 9-27):

- The 24-hour threshold for PTS in LF cetaceans may be met if animals remain within 0.26 km of the activity, based on acoustic modelling results. However, the more accurate exposure modelling predicted that no animals were exposed above the threshold.
- The 24-hour threshold for TTS in LF cetaceans may be met if animals remain within 4.05 km of the activity, based on acoustic modelling results. However, the more accurate exposure modelling predicted this threshold would only be met if animals remain within 80 m of the activity.
- The 48-hour threshold for recoverable injury for fish with a swim bladder involved in hearing and dusky sea snakes (Popper et al. 2014) was not predicted to be met.
- The 12-hour threshold for TTS for fish with a swim bladder involved in hearing (Popper et al. 2014) and dusky sea snakes may be met if the animals remain within 80 m of the activity.
- The risk of exceeding the recoverable injury threshold for fish without a swim bladder (including whale sharks) is Low for any distance to continuous underwater noise.
- The threshold for marine mammal behavioural response to continuous noise (NOAA 2024) was reached at 25.9 km based on acoustic modelling results; however, the more accurate exposure modelling predicted this threshold would be met within a maximum distance of 18.9 km from the activity (see Table 9-26).

Table 9-26: Modelled Maximum Horizontal Distances (R_{max}) and 95th Percentile ($ER_{95\%}$) Exposure Ranges for Pygmy Blue Whales for Scenario 2

Modelling Approach	Parameter	PTS	TTS	Behavioural[29]
Acoustic modelling	Maximum Range (R_{max})	SEL_{24h}: 0.26 km	SEL_{24h}: 4.05 km	SPL: 25.9 km
Exposure modelling (JASMINE)	North-bound Migration			
	$ER_{95\%}$	N/A	SEL_{24h}: 0.08 km	SPL: 18.9 km
	Probability	N/A	SEL_{24h}: 39%	SPL: 82%
	South-bound Migration			
	$ER_{95\%}$	N/A	SEL_{24h}: 0.08 km	SPL: 18.2 km
	Probability	N/A	SEL_{24h}: 34%	SPL: 86%

[29] SPL (120 dB re 1 µPa) recommended unweighted behavioural threshold for marine mammals (NOAA 2024)

Table 9-27: Cumulative (All Vessels) Exposure Scenario with Maximum Distances to Thresholds

Hearing group	Threshold Criteria (Continuous)	Max Distance from Vessels (km)
PTS		
LF cetaceans	197 SEL_{24h}[30]	0.26
HF cetaceans	201 SEL_{24h}	N/A
VHF cetaceans	181 SEL_{24h}	0.05
Sirenians	200 SEL_{24h}	N/A
Turtles	198 SEL_{24h}	0.22
Sharks, rays, and other fish and dusky sea snakes	170 SPL[31]	N/A
TTS		
LF cetaceans	177 SEL_{24h}	4.05
HF cetaceans	181 SEL_{24h}	0.36
VHF cetaceans	161 SEL_{24h}	1.95
Sirenians	180 SEL_{24h}	0.25
Turtles	178 SEL_{24h}	1.91
Sharks, rays, other fish and dusky sea snakes	158 SPL[32]	0.08

The distances over which modelling indicates sound generated from the activities may exceed behavioural thresholds were used to determine a Noise Assessment Area—defined as 20 km around the Prelude FLNG facility location (see Section 7.1 for justification).

9.5.2 Description and Evaluation of Impacts

The Prelude FLNG facility and associated subsea infrastructure are in water depths of approximately 237 m. Fauna that may be present within the Activity Area will mainly comprise pelagic and demersal fish species, with migratory species (including cetaceans, dugongs, turtles, and whale sharks) potentially transiting the area seasonally.

An EPBC Act protected matters search was undertaken for the Noise Assessment Area. The Noise Assessment Area overlaps with the whale shark BIA, which broadly follows the 200 m isobath up the north-west coast of WA (Figure 7-25). Whale sharks are expected to be seasonally present, mainly from July to November, transiting through the Noise Assessment Area as part of their broad migratory movements to/from Ningaloo. However, the whale shark is known to occur within the Activity Area, with crew onboard the Prelude FLNG facility having observed the species.

Table 9-28 indicates the environmental features, values and sensitivities that have been identified to be potentially affected by the noise associated with the activities covered by this EP, with further evaluation of the impacts and/or risks to each potentially affected receptor category (including cumulative impacts) provided in Sections 9.5.2.1 to 9.5.2.8. Features or values and sensitivities which could not be credibly affected by activity noise emissions are not discussed further.

[30] Frequency-weighted SEL 24h PTS and TTS thresholds (Accomando et al. 2025)

[31] 48h threshold for recoverable injury for fish with a swim bladder involved in hearing (Popper et al. 2014)

[32] 12h threshold for TTS for fish with a swim bladder involved in hearing (Popper et al. 2014)

Table 9-28: Noise Receptor Impact Screening Summary

Receptor	Protected Areas			Features																Values and Sensitivities																				
				Physical		Natural				Socioeconomic								Heritage and Cultural			Physical				Natural								Socioeconomic							Heritage and Cultural		
	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect									×															×	×					×											×

Legend:		
		Potentially affected
	×	Predicted impact

9.5.2.1 Physical Features

Marine Regions

The localised and generally temporary nature of noise emissions generated by the activity precludes discernible impacts to the identified physical features of the region (Magnitude: 0, Sensitivity: L).

9.5.2.2 Physical Values and Sensitivities

9.5.2.2.1 Underwater Noise

The activity will generate underwater noise from both ongoing operational sources (e.g. flowlines, facility machinery and equipment) and from intermittent activities, such as offtakes, supply vessels and IMR activities. Generally, the underwater noise generated during operations is low intensity and the potential changes to ambient underwater noise levels would be limited to close proximity to the infrastructure. During offtakes, vessel operations and IMR campaigns, noise emissions will cause greater increases in ambient underwater noise levels. The environmental implications of changes in ambient underwater noise levels relate primarily to potential impacts on marine fauna, which are discussed below.

The overall residual impact consequence level to underwater noise is ranked as Slight (Magnitude: –1, Sensitivity: L).

9.5.2.3 Natural Features

9.5.2.3.1 Timor Province Bioregion

Benthic Communities

Underwater noise generated by operational facilities does not appear to have any detrimental effect on benthic communities. Inspection of fixed facilities and subsea infrastructure worldwide shows these structures serve as artificial reefs and develop relatively diverse benthic communities (Lindquist et al. 2005). Benthic habitat surveys in the Browse region indicated a very low abundance of macrobenthic fauna (Fugro 2017a; AECOM 2017). It is considered that, while the latter study was more of a general characterisation study and may not have provided an extensive and statistically robust dataset for future impact assessment comparison, it was sufficient to provide an adequate characterisation of the typical benthic communities present to conclude that the modelled noise levels would not pose a risk of significant impacts upon them (Magnitude: 0, Sensitivity: L).

Pelagic Communities

Pelagic communities in the Noise Assessment Area include planktonic communities and pelagic fish and invertebrates. Threatened and migratory species of fish (including sharks and rays) are discussed in Section 9.5.2.4.4.

Planktonic communities have a diverse range of taxa, which will differ in their potential to be impacted by underwater noise. Many species of pelagic and demersal fish have a planktonic larval stage. Modelling studies by the CSIRO indicate that planktonic communities are highly dynamic and have the potential to recover rapidly following disturbance (Richardson et al. 2017). Experiments have shown mixed results of larval stages to underwater noise. For example, experiments on several species of fish larvae and lobster larvae did not detect significant effects as a result of high intensity impulsive noise (Bolle et al. 2012; Day et al. 2016; Payne et al. 2009). Impacts to planktonic larvae have not been reliably demonstrated under conditions analogous to those that will be encountered during Prelude operations, being orders of magnitude less than that of experimental designs referenced above. The more intensive noise sources are of limited duration (e.g. vessels using DP), which limits the exposure of planktonic organisms. As such, the residual impact consequence to planktonic communities are considered to be Slight (Magnitude: –1, Sensitivity: L).

The noise modelling predicted that under the ‘worst-case’ scenario representative of activities covered by this EP (scenario 2) the 12-hour threshold criteria for TTS in the most noise-sensitive fish (i.e. fish with a swim bladder involved in hearing) may be reached if individuals remain within 80 m of the operations. Notably, the criteria may only be met if the individual is exposed to sound levels at or above the threshold criteria continuously over a period of 12 hours. The 48-hour threshold for recoverable injury for fish with a swim bladder involved in hearing was not predicted to be met.

Given the highly mobile nature of fish and their continual sightings in the Activity Area around the hull, it is concluded that continuous noise sources from the FLNG in its production only and simultaneous production and offloading modes of operation will have at most a Slight residual impact consequence (Magnitude: –1, Sensitivity: L) on resident and transient fish populations. This is based on the limited spatial extent of predicted noise levels that may exceed impact criteria and the low numbers of individuals from any species likely to occur within the affected area.

9.5.2.4 Natural Values and Sensitivities

9.5.2.4.1 BIAs

The Noise Assessment Area overlaps a very small proportion of the whale shark low density foraging BIA. This BIA extends northwards from Ningaloo across the North West Shelf and the Browse Basin along the 200 m isobath and covers an area of ~224,416 km^2 (see Figure 7-25) and supports migration of whale sharks to/from the Ningaloo aggregation area. Impacts to whale sharks using this BIA are described in Section 9.5.2.4.4. Given the generally low sensitivity to noise emissions in whale sharks, the very small proportion of the BIA that may be affected by activity noise emissions, potential impacts on the functional values of the BIA are assessed to have a Slight residual impact consequence (Magnitude: –1, Sensitivity: M).

9.5.2.4.2 Shoals and Banks

No shoals, banks or offshore islands are within the Noise Assessment Area, with the nearest shoal, Echuca Shoals ~62 km from Prelude and the nearest Island, Browse Island ~42 km. Based on the predicted noise attenuation away from noise sources within the Activity Area, as demonstrated by modelling (Connell et al. 2025), there is no credible potential for impacts to benthic or fish communities at these shoals as a result of the activity (Magnitude: 0, Sensitivity: L).

9.5.2.4.3 Key Ecological Features

The nearest KEF to the Activity Area is the Continental Slope Demersal Fish Communities, covering a vast area of approximately 33,182 km^2, located approximately 17 km in its closest point to Prelude FLNG. The Noise Assessment Area overlaps a small portion (<0.05%) of the Continental slope demersal fish communities KEF. This KEF covers a vast area (~33,182 km^2) and has a high diversity of demersal fish assemblages featuring >500 fish species.

The noise levels at the closest point of this KEF will be between 120 and 110 dB re 1 µPa in the 10 Hz to 2 kHz band. At these distances there is no potential for permanent, temporary or behavioural impact to fish with moderate potential for masking fish choruses only. Therefore, there is no credible potential for impacts to the demersal fish communities given the negligible proportion of the KEF involved (Magnitude: 0, Sensitivity: M).

9.5.2.4.4 Threatened and Migratory Species

An EPBC Act protected matters search was undertaken for the Noise Assessment Area with no additional species identified within the Noise Assessment Area compared to the Activity Area (Appendix C).

Marine Mammals

Marine mammals that may occur within the Noise Assessment Area include cetaceans and sirenians. Most cetacean species use sound to communicate (e.g. humpback whale calls) or perceive their environment (e.g. echolocation of prey). This reliance on underwater noise, and their high conservation value, makes cetaceans a focus when assessing potential impacts from underwater noise. The effects of anthropogenic noise on cetaceans may be exacerbated if they interfere with the animal's use of sound in areas that support important lifecycle behaviours. LF cetaceans are expected to be most vulnerable to underwater noise from the activity.

There are no known cetacean (or other marine mammal) BIAs within the Noise Assessment Area. Several LF cetaceans (including pygmy blue, humpback, sei, fin, and Bryde's whales) were identified as potentially occurring within the Noise Assessment Area (see Section 7.7.10), with several sightings of pygmy blue and humpback whales from the Prelude FLNG having been previously reported. Noise monitoring in the Timor Sea for the Barossa Gas Project indicated pygmy blue, Omura's and Bryde's whales are the most likely to occur (McPherson et al. 2016, McPherson pers. comm. JASCO 2023).

The closest known LF cetacean BIA is the migration BIA for pygmy blue whales, which is ~78 km from the Prelude FLNG facility. Thums et al. (2022) and Ferreira et al. (2024) found that pygmy blue whales demonstrate

extensive use of slope habitat off the WA coastline and only limited use of shelf waters, suggesting a presence mostly in water depths >250 m. During their migratory period, pygmy blue whales predominantly travel fast, with directed travel interspersed with relatively short periods of low movement persistence, indicating foraging, resting or breeding behaviours along the WA coastline (Thums et al. 2022, Thums et al. 2025). The Perth Canyon, Cape Range Canyon and Cloates Canyon (Thums et al. 2022, Thums et al. 2025) were identified as key areas associated with these slower behaviours, supporting the 'possible' foraging areas identified in the Blue Whale Recovery Plan (CoA 2015a). During migration periods, pygmy blue whales are more likely to travel in greater numbers through the region in the deeper, and further offshore waters within their known BIA (outside the Noise Assessment Area), and are therefore outside the identified areas of potential impacts from underwater noise from the activity.

HF and VHF cetaceans are also vulnerable to underwater noise, although their functional hearing range means they are more vulnerable to higher noise frequencies which attenuate more rapidly. Several species of HF and VHF cetaceans were identified as potentially occurring within the Noise Assessment Area (see Section 7.7.10). Noise monitoring in the Timor Sea indicates HF and VHF cetaceans are present year-round (McPherson et al. 2016, McPherson pers. comm. 2023). Dugongs (sirenians) have similar hearing ranges to HF cetaceans but have been assigned their own assessment category in accordance with Accomando et al. (2025) and have been incorporated into this assessment based on anecdotal sightings within or in close proximity to the Activity Area (pers comm Craig McPherson, JASCO 2023). The closest known sirenian BIA to the Prelude FLNG is the dugong high density seabed foraging BIA, ~168 km away.

The animat exposure modelling results for the 'worst-case' scenario of offtake operations predicted that noise would not exceed the pygmy blue whale PTS impact threshold, and that the TTS impact threshold would only be exceeded within 80 m, with only a 39% probability of the animat being exposed above the threshold. Notably, an animal would need to remain swimming within 80 metres of the facility for more than 24 hours to experience auditory injury, which is not a credible scenario. The modelling also predicted that the marine mammal behavioural response criterion of 120 dB re 1 µPa (SPL; L_p) for non-impulsive sources (NMFS 2024), may be exceeded for animals present within 18.9 km of offtake operations. Studies of cetaceans exposed to acoustic disturbance shows typical behavioural response is to move away from unpleasant stimuli, unless motivated to remain in the area due to biologically important activities (such as feeding or breeding). Several species of cetacean, including humpback whales, have been shown to avoid high-intensity low frequency sound (Dunlop et al. 2013; Kvadsheim et al. 2017; Sivle et al. 2015). Notably, Accomando et al. (2025) propose a revised behavioural response threshold criterion for all baleen whales, set at 185 dB re 1 µPa rms, which has been adopted for use by the US Navy. The revised criterion is based on new data obtained from studies on the effects from low- and mid-frequency noise on marine mammal behaviour that indicated a higher tolerance as compared to NMFS (2024) and as adopted by this EP. Furthermore, the data indicated no significant response from minke whales, fin whales, humpback whales or blue whales beyond 8 km, and as such a cut-off range of 10 km has been implemented for US naval exercises (Accomando et al. 2025). Given the absence of any BIAs within the noise assessment area and the conservative behavioural response criterion adopted by the EP, behavioural responses that result in biological consequences are not credible.

Based on the results of the noise assessment, the cetacean species that may occur within the Noise Assessment Area and the controls Shell will implement, potential impacts are expected to involve behavioural disturbance only. The behavioural disturbance may involve avoidance of areas of high noise intensity. The nearest known BIA for whales is the seasonal migratory corridor for pygmy blue whales, which is ~78 km from the Prelude FLNG facility. Behavioural disturbance is therefore expected to involve low numbers of animals and to be restricted to short periods when high noise intensity activities are occurring. Once the noise stops (i.e. the activity ceases), animal behaviour is expected to return to normal. Due to the anticipated behavioural responses (i.e. avoidance) and the controls that will be implemented (e.g. whale interaction procedures), potential impacts such as mortality, auditory injury, PTS and TTS are not considered to be credible.

The overall impact consequence for marine mammals is considered to be Slight (Magnitude: –1, Sensitivity: M).

Marine Reptiles

The short-nosed, leaf-scaled and dusky sea snakes are not expected to be present within the Activity Area, and there are no known or likely dusky sea snake habitat (DCCEEW 2024l) that fall within the Noise Assessment Area. The nearest areas where the dusky sea snake habitat may occur include Echuca Shoals

(~62 km), Heyward Shoals (~84 km), and Vulcan and Goeree Shoals (~125 km from the Activity Area). Therefore, there is no credible potential for impacts to the dusky sea snake as a result of the activity.

The Recovery Plan for Marine Turtles in Australia (CoA 2017b) identifies noise interference as a key threat. Although marine turtles do not have external ears, they use sound for navigation and location of prey and avoidance of predators. Exposure to chronic loud noise in the marine environment therefore may lead to avoidance of important habitat. Research on marine turtles suggests that functional hearing is concentrated at frequencies between 100 and 600 Hz (which is a subset of the LF cetacean range). Several turtle species were identified as likely to occur within the Noise Assessment Area (no additional species were identified compared to the Activity Area) (Section 7.7.10.2) however no critical habitat or BIAs for these species overlap the Noise Assessment Area.

The noise modelling indicates that the 24-hour cumulative PTS and TTS threshold for turtles (from Accomando et al. 2025) would be exceeded at 0.22 km and 1.91 km, respectively for the 'worst case' offtake scenario. Notably, SEL_{24h} is a cumulative metric that assumes the receptor is consistently exposed to the relevant noise effect criteria over a period of at least 24 hours prior to the potential onset of TTS. Importantly, the threshold criteria adopted from Accomando et al. (2025) are considered conservative, as they were based on data from freshwater turtles, which exhibit greater auditory sensitivity than their marine counterparts.

Considering no known marine turtle BIAs or habitat critical to their survival occur within the Noise Assessment Area, and marine turtles (if present) are expected to be individuals transiting through the area, the risk of auditory impairment is considered unlikely.

There is a paucity of knowledge on the behavioural effects to marine turtles from underwater noise, including non-impulsive noise. As such, thresholds for effects on marine turtles from underwater noise have been derived from studies on fish. Popper et al. (2014) considers the risk of behavioural effects to marine turtles is high 'near' the source (within tens of metres), moderate at an 'intermediate' distance (within hundreds of meters), and low at a 'far' distance from the source (thousands of metres) (Table 9-23).

Based on the results of the noise assessment, potential impacts to marine reptiles are considered likely to be restricted to short-term behavioural disturbance to animals close to high-intensity noise sources. Given the absence of BIAs and expected low density of marine reptiles within the Noise Assessment Area, this potential impact would only affect a relatively small portion of turtle populations in the region. Recovery from behavioural disturbance is expected to occur immediately once the noise emissions stop. The overall impact consequence for marine reptiles is considered to be Minor (Magnitude: –2, Sensitivity: M).

Sharks and Rays

Sharks and rays (elasmobranchs) are not considered to be particularly vulnerable to noise-related impacts and were categorised as 'fish with no swim bladder' when determining impact thresholds. The Noise Assessment Area is not likely to support significant aggregations of any of the listed species of elasmobranchs that may occur in the region (Section 7.7.10.3.2) and the only recognised BIA that overlaps the area is the whale shark 'low density' foraging BIA, located ~17 km from the Prelude FLNG facility.

Whale sharks are known to occur in the Activity Area, with crew on board the Prelude FLNG facility having observed the species. However, it is expected that whale shark presence within the Activity Area would not be in significant numbers and would be transitory and of short duration. This is consistent with tagging studies of whale shark movements which show continual movement of whale sharks in deeper, open offshore waters (Meekan & Radford 2010, Ferreira et al. 2024). Given the contrast to the feeding behaviour in aggregation areas such as Ningaloo Reef, the BIA within the Noise Assessment Area is considered unlikely to be a dedicated foraging area; rather, it is likely to be a broad area within which migratory movements can be expected. This is consistent with the Conservation Advice (DoE 2015e) for this species, which indicates that the BIA along the north-west coast is a migration corridor rather than significant foraging habitat. There are no constraints (e.g. shallow water, shorelines) that would prevent whale sharks moving away from a noise source and the BIA is not considered a confined pathway. The Conservation Advice for the whale shark does not identify noise as a threat to the species (DoE 2015e) and it is not listed as a pressure on the whale shark in the Marine Bioregional Plan for the NWMR (DSEWPaC 2012).

Whale sharks forage on plankton and small fish, and high-intensity underwater noise has been shown to impact some taxa within zooplankton communities. However, potential effects on plankton and small fish from the

noise sources associated with the activity are expected to be localised and short-term (Section 9.5.2.3). As a result, it is considered that any minor impacts to zooplankton, which would be of short duration, and would not have the potential to negatively affect any whale sharks moving through the area. Note: Small crustacean zooplankton comprise only part of whale shark diets, with larger plankton and nekton (e.g. krill, baitfish) forming a part of their diet (Colman 1997).

The noise modelling suggests that the 12-hour threshold criteria for TTS may be reached, for fish with a swim bladder involved in hearing, if the fish remain within 80 m of the facility during offtake operations. The 48-hour criteria for recoverable injury for fish with a swim bladder involved in hearing was not predicted to be met for any scenario. As fish with no swim bladder, including elasmobranchs such as the whale shark, are less sensitive to underwater noise, exposure to noise levels that might result in injury or TTS in threatened or migratory sharks and rays would require the species to remain in very close proximity to the facility for an extended period, which is considered highly unlikely.

Based on the results of the noise assessment, the potential impacts to EPBC Act listed sharks and rays, including whale sharks, are expected to be no more than Slight (Magnitude: –1, Sensitivity: M).

9.5.2.5 Socioeconomic Features

9.5.2.5.1 Fishing Industry

The Noise Assessment Area intersects the authorised fishing zones (management areas) for several commercial fisheries. However, the proportion of any these management areas potentially affected by the localised, and generally temporary nature of noise emissions associated with the facility activities is negligible (Magnitude: 0, Sensitivity L).

9.5.2.6 Socioeconomic Values and Sensitivities

9.5.2.6.1 Fishing Industry

Assessment of the potential effects of activity noise on fish and invertebrates that may form part of the commercial stocks indicates (Sections 9.5.2.3 and 9.5.2.4.4) that impacts are likely to be highly localised and typically short lived. The sources of elevated underwater noise associated with the activity are similar to those used by the fishing industry. Potential impacts to commercially targeted fish resources are expected to be insignificant at a stock level. Therefore, it is unlikely there will be any impacts to commercial fisheries in the Noise Assessment Area from activity noise, given the scale of the fisheries and the size of the area of potential impacts from noise (Magnitude: 0, Sensitivity: L).

9.5.2.7 Heritage and Cultural Values and Sensitivities

9.5.2.7.1 Indigenous Cultural Heritage

Shell has not identified any cultural values, such as songlines, through desktop research or consultation during the preparation of this EP which may be impacted by the planned activities in this EP. Noise is unlikely to result in significant impacts to marine species of cultural significance with the proposed control measures in place. For the assessment of impacts to marine species that may be of cultural significance, see Section 9.5.2.4.4. Shell has adopted the precautionary principle, in accordance with the principles of ESD in order to manage potential impacts on intangible cultural values for this activity. Therefore, impacts to Indigenous cultural values are ranked as Slight (Magnitude: –1, Sensitivity: L).

9.5.2.8 Cumulative Impacts

The remoteness of the Activity Area means cumulative impacts from concurrent impacts from concurrent operations with other marine users during normal operations are unlikely to exceed relevant thresholds. The closest operating facilities to the Prelude FLNG are Ichthys, Montara and Crux, located approximately 17 km, 60 km and 165 km away, respectively.

IMR activities associated with the Crux pipeline may occur within the vicinity of the Prelude FLNG facility. The IMR noise sources include vessels and may involve acoustic surveys and positioning equipment, if required. Therefore, there is the potential for cumulative sound emissions during Crux IMR activities toward the Prelude–end of the pipeline. Vessel-based IMR along the pipeline is expected to occur infrequently (e.g. annually or less frequently). The potential for behavioural disturbance due to cumulative noise effects will therefore be

very short-term and relatively localised. There are no known BIAs for noise-sensitive fauna within the area that might be affected.

Notwithstanding the potential overlap of the spatial extent of noise effects from concurrent activities, the infrequent and relatively short duration of these activities, the absence of significant feeding, breeding or aggregations areas and noise-sensitive marine fauna BIAs within the predicted noise ranges, and the mobility of noise-sensitive fauna species that may transit through the area suggests there will be negligible additive and cumulative noise effects beyond those predicted for the activity, and no change to the overall consequence level for noise impacts is expected to result.

9.5.3 Impact Assessment Summary

Table 9-29 lists the highest residual impact consequence ranking of the relevant environmental receptor groups.

Table 9-29: Noise Evaluation of Residual Impacts

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Evaluation – Planned Impacts			
Protected Areas	N/A	N/A	N/A
Physical Features	0	L	No Impact
Physical Values and Sensitivities	−1	L	Slight
Natural Features	−1	L	Slight
Natural Values and Sensitivities	−2	M	Minor
Socioeconomic Features	0	L	No Impact
Socioeconomic Values and Sensitivities	0	L	No Impact
Heritage and Cultural Features	N/A	N/A	N/A
Heritage and Cultural Values and Sensitivities	−1	L	Slight

9.5.4 ALARP Assessment and Environmental Performance Standards

Table 9-30: Noise – ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	N/A	N/A	No additional or alternative control measures have been identified.	N/A	N/A	N/A
Substitution	N/A	N/A	No additional or alternative control measures have been identified.	N/A	N/A	N/A
Administrative and Procedural	Vessels comply with EPBC Regulations 2000 Part 8, Division 8.1 Interacting with Cetaceans.	Yes	The EPBC Regulations 2000 – Part 8 Division 8.1 (Regulations 8.05 and 8.06) is recognised as the industry standard procedure for minimising disturbance due to physical presence and noise to whales and dolphins and will be applied to other species as relevant (i.e. turtles and whale sharks).	3.1	Vessel interactions with EPBC listed species to follow the EPBC Regulations 2000 – Part 8 Division 8.1 (Regulations 8.05 and 8.06). In particular: • Vessels will not deliberately approach closer than 50 m to a dolphin, turtle or whale shark; 100 m for an adult whale; 300 m for a whale calf; and 150 m for a dolphin calf. • If the whale, dolphin, turtle, or whale shark shows signs of being distressed, vessels will immediately withdraw from the caution zone at a constant speed of ≤6 knots (except in emergency conditions or when manoeuvring is not possible).	Vessel reports demonstrate adherence to EPS 3.1 requirements. Incident report form used to record breaches of requirements outlined in the EPBC Regulations 2000.
Administrative and Procedural	Verification of noise levels through underwater noise monitoring.	No	Monitoring of underwater noise levels requires the use of vessels and deployment/recovery of specialist equipment, with associated safety and environment risks, including additional emissions and spill risk. The Noise Assessment Area does not overlap any whale (or other noise-sensitive fauna) species BIA and activity-specific noise modelling indicates the risk of impacts is low. The proposed control measure will not, in itself, reduce impacts and the costs/risks are disproportionate to any potential benefit.	N/A	N/A	N/A
ALARP Demonstration Statement						
Based on the impact assessment outcomes and control measures adopted, Shell considers implementing the control measures appropriate to manage the potential impacts associated with activity noise emissions. No additional, alternative, or improved controls were identified that could further reduce the impacts—beyond negligible environmental benefits if any—without disproportionate effort and cost. Therefore, the impacts are considered to be reduced to ALARP.						

9.5.5 Acceptability of Impacts

Table 9-31: Acceptability of Impacts – Noise

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Subcategory**			
Physical features, values and sensitivities	Underwater noise	No increase in underwater noise that will have a substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution.	Yes	Increases in ambient underwater noise levels will be localised and/or temporary, involving a small fraction of similar habitat in the region. There will be minimal adverse effects on any population of marine species, including cetaceans.
Natural features, values and sensitivities	Marine bioregions	No significant impacts to benthic habitats and communities. No significant adverse effect on pelagic communities, populations, habitats or spatial distribution of a species. No substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution.	Yes	Experience elsewhere indicates the facility hull, and subsea structures are likely to be colonised by encrusting biogrowth. Soft sediment benthic communities within areas potentially exposed to activity noise are broadly distributed in the wider region and are not considered to be unique or highly sensitive. It is considered that there is not a credible risk of underwater noise resulting in significant impacts to benthic communities within the Noise Assessment Area. Modelling indicates activity noise will have only localised and/or temporary effects on pelagic communities and plankton within the bioregion, with minor impact consequences and no substantial adverse effect on a population level for affected species.

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	Subcategory			
	BIA's	No significant impacts to functional values of BIAs. Impacts do not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat that results in an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area.	Yes	The impact assessment area only overlaps very small proportion of the whale shark low density foraging BIA. Potential for TTS would require animals to remain within hundreds of metres of operating vessels for an extended period; avoidance behaviours or a lack of preferred habitat with the Activity Area are expected to make this unlikely. Given the absence of aggregations or BIAs within areas where behavioural effects may occur, noise levels emitted from the activity have been assessed as potentially able to cause only a slight impact to whale sharks. Whale sharks are not predicted to be exposed to underwater noise exceeding mortality or injury exposure thresholds (see threatened and migratory species assessment).
	Threatened, migratory, marine and cetacean species	No mortality or injury of cetaceans. Management of aspects of the activity must align with conservation advice, recovery plans and threat abatement plans. No significant impacts to EPBC Act listed threatened, migratory, marine or cetacean species. MNES fauna populations as a result of noise emissions.	Yes	PTS in marine mammals or marine reptiles is not considered credible. Potential for TTS in LF cetaceans or marine reptiles would require animals to remain within hundreds of metres of operating vessels for an extended period; avoidance behaviours or a lack of preferred habitat with the Activity Area are expected to make this unlikely. Given the absence of aggregations or BIAs within areas where behavioural effects may occur, noise levels emitted from the activity have been assessed as potentially able to cause only a minor impact to marine mammals and turtles. No EPBC Act listed sharks and rays (including whale sharks) predicted to be exposed to underwater noise exceeding mortality or injury exposure thresholds. The relevant TTS criteria for fish is limited to within ~200 m radius of 'worst case' scenario noise emissions. Potential for masking vocalisation and changes to behaviour is temporary and localised and not expected to have significant impacts on any species.

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	Subcategory			
				Assessment of impacts and management requirements of relevant conservation advice, recovery plans and threat abatement plans and showed no misalignment. No significant impacts, mortality or injury predicted to threatened, migratory, marine and cetacean species.
Heritage and Cultural Features, Values and Sensitivities	Indigenous Cultural Heritage Values	No significant impacts to Indigenous cultural heritage values.	Yes	Impacts to Indigenous cultural heritage from underwater noise are limited to species of cultural significance, for which no significant impacts are predicted (see threatened and migratory species assessment).

The assessment of impacts from noise determined the worst-case residual ranking of Minor or lower (Table 9-29). The acceptability of the potential impacts from noise associated with the activity have been considered in the following context:

Principles of ESD

The potential impacts from underwater noise emissions are consistent with the principles of ESD because:

- The underwater noise emissions aspect does not degrade the biological diversity or ecological integrity of the Commonwealth Marine Area and significant impacts to MNES are not anticipated to occur
- The precautionary principle has been applied, and the most recent scientific literature and international guidelines on noise impacts (Popper et al. 2014; NMFS 2024; Accomando et al. 2025) have been reviewed and referenced to ensure the latest research and knowledge was taken into account when evaluating environmental impacts.

Relevant Requirements

Managing the potential impacts from noise emissions is consistent with relevant requirements, including:

- Noise impact assessments are guided by the latest scientific research in defining impact thresholds
- Policies, strategies, guidelines and conservation advice (see Table 9-32)
- Vessel interactions with cetaceans will follow the EPBC Regulations 2000 – Part 8 Division 8.1 (Regulations 8.05 and 8.06) and the Australian National Guidelines for Whale and Dolphin Watching 2017 (DoEE 2017), with additional requirements applied for turtles and whale sharks, including:
  - vessels will not deliberately approach closer than 50 m to a dolphin, turtle or whale shark; 100 m for an adult whale; 300 m for a whale calf; and 150 m for a dolphin calf
  - if the whale, dolphin, turtle or whale shark shows signs of being distressed, the vessel will immediately withdraw from the caution zone at a constant speed of ≤6 knots.

Matters of National Environmental Significance

Threatened and Migratory Species

The evaluation of noise impacts indicates that no credible significant impacts to threatened and migratory species is predicted to result from underwater noise emissions during the activity. Table 9-32 summarises the alignment with management plans, recovery plans and conservation advice for threatened and migratory fauna.

Commonwealth Marine Environment

Any potential impact from the noise emissions of the activity on the Commonwealth marine environment are predicted to not exceed any of the significant impact criteria provided in Table 9-31. As such, it is considered that the aspect does not pose a credible risk to the Commonwealth marine environment.

Table 9-32: Summary of Alignment with Relevant MNES Considerations

MNES	MNES Acceptability Considerations	Demonstration of Alignment as Relevant to the Project
Threatened and Migratory Species - Marine Mammals	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1).	The evaluation of environmental impacts indicates that potential impacts from noise emissions on threatened or migratory marine mammals are predicted to be slight and would not constitute a significant impact. As such, the activities do not exceed any of the significant impact criteria for threatened and migratory marine species as listed in Table 8-1.
	Approved Conservation Advice *Balaenoptera borealis* (sei whale) (DoE 2015c)	Vessel interactions with threatened and migratory species will follow the EPBC Regulations 2000 – Part 8 Division 8.1 (Regulations 8.05 and 8.06).

MNES	MNES Acceptability Considerations	Demonstration of Alignment as Relevant to the Project
	Conservation Advice on fin whale (*Balaenoptera physalus*) (TSSC 2015b)	A noise assessment consistent with the recommendations of the Technical Guidance for assessing the effects of anthropogenic sound on marine mammal hearing (NMFS 2024) was undertaken.
	Conservation advice on humpback whale (*Megaptera novaeangliae*) (DoE 2015b)	
	Conservation management plan for the blue whale: A recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015–2025 (CoA 2015a)	
Threatened and Migratory Species - Marine Reptiles	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1).	The evaluation of environmental impacts indicates that potential impacts from noise emissions on threatened or migratory marine reptiles are predicted to be slight and would not constitute a significant impact. As such, the petroleum activities do not exceed any of the significant impact criteria for threatened and migratory marine species as listed in Table 8-1.
	Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA 2017b)	Acute and chronic noise pollution has been identified as a threat in the Recovery Plan for Marine Turtles (DoEE 2017), however there are no specific actions in the Plan in relation to noise pollution, except a recognised need to conduct additional research on impacts of noise on turtles. A noise assessment consistent with the sound exposure level guideline recommendations for marine turtles (McCauley et al. 2000; Finneran et al. 2017, Accomando et al. 2025) was undertaken.
	Conservation Advice on whale shark (*Rhincodon typus*) (DoE 2015e)	A noise assessment consistent with the recommendations of the sound exposure guidelines for fishes and marine turtles was undertaken. This considered the potential impacts of underwater noise on whale sharks.
Commonwealth Marine Environment	Significant Impact Guidelines for the Commonwealth marine environment (Table 8-1)	The evaluation of environmental impacts indicates that the noise emissions aspect of Prelude operations will not exceed the Commonwealth marine environment significant impact criteria provided in Table 8-1.

External Context

No objections or claims have been raised by relevant persons to date regarding underwater noise. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4.

Internal Context

Shell also considered the internal context, including Shell's environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented for the activity, are consistent with the outcomes from consultation for the petroleum activity and Shell's internal requirements.

Acceptability Summary

The assessment of impacts and risks from noise determined the residual impact rankings were Minor (Table 9-29). The acceptability of impacts from underwater noise have been considered in the context of:

- the established acceptability criteria for the noise aspect
- ESD
- relevant requirements
- MNES
- external context (i.e. relevant persons claims or objections)
- internal context (i.e. Shell requirements).

Shell considers residual impacts of noise of Minor or lower to be acceptable if they meet legislative and Shell requirements. The discussion above demonstrates that these requirements have been met in relation to noise. Shell considers the potential impacts from Activity noise to be ALARP and acceptable.

9.5.6 Environmental Performance Outcome

EPO #	EPO	Measurement Criteria
2.1	No injury or mortality of threatened, migratory or cetacean species associated with the Activities.	Reports of injury or mortality of EPBC listed threatened, migratory or cetacean species associated with the Activities sent to NOPSEMA and DCCEEW in accordance with requirements outlined in Table 10-13.

9.6 Seabed Disturbance

9.6.1 Aspect Context

Seabed disturbance can alter habitat conditions, resulting in changes to epifauna and infauna (living on and in the sediment) communities (Newell et al. 1998). The seabed within the Activity Area is characterised by unconsolidated substrates (sand, gravel, mud etc.) interspersed with patches of hard substrate, which provide attachment points for sponges and molluscs. This habitat is widespread throughout the region and is not particularly unique or sensitive.

Seabed disturbance may be caused by the following activities:

- replacement of subsea equipment/infrastructure
- temporary placement of structures on the seabed
- IMR activities such as free-span rectification, scour protection, grout bags/mattress installation, pipeline secondary stabilisation and/or water jetting/sand displacement to allow access to infrastructure.

These activities are infrequent and at worst will result in a localised, temporary disturbance. The physical presence of permanent infrastructure already installed is addressed in Section 9.3 and is not considered further in this section. Other activities and unplanned events that may result in seabed disturbance are discussed in Sections 9.13and 9.15.

9.6.2 Description and Evaluation of Impacts

Table 9-33 identifies the environmental features and values and sensitivities potentially affected by the localised seabed disturbance that may result from the activities covered by this EP, with further evaluation of the impacts and/or risks to each potentially affected receptor category (including cumulative impacts) provided in Sections 9.6.2.1 to 9.6.2.7. Features or values and sensitivities which could not be credibly affected by seabed disturbance are not discussed further.

Table 9-33: Seabed Disturbance Receptor Impact Screening Summary

	Protected Areas			Features																	Values and Sensitivities																				
				Physical		Natural				Socioeconomic								Heritage and Cultural			Physical				Natural							Socioeconomic							Heritage and Cultural		
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect									×													×	×																		

Legend:		
		Potentially affected
	×	Predicted impact

9.6.2.1 Physical Values and Sensitivities

9.6.2.1.1 Water and Sediment Quality

Subsea maintenance and repair activities may cause a localised increase in turbidity due to the resuspension of sediment and unconsolidated material. Sediment plumes from these activities are expected to cause slight and temporarily decreases in water quality.

Any seabed disturbance associated with temporary placement of equipment/materials will be within the Activity Area and limited to a very localised contact footprint on the seabed.

The overall residual impact consequence level to water and sediment quality is ranked as Slight (Magnitude: –1, Sensitivity: L).

9.6.2.2 Natural Features, Values and Sensitivities

9.6.2.2.1 Timor Province Bioregion

Sediment coating resulting from elevated turbidity/total suspended solids (TSS) can potentially cause clogging or damage to the physiological functioning of biota such as sea pens and polychaetes that rely on external respiratory and feeding structures. ROV disturbance will be the main cause of turbidity increase during operations but will be a temporary and short duration activity causing very localised disturbance. Soft sedimentary communities are known to recover rapidly from temporary disturbance. The water depths in the Activity Area, and the highly localised nature of turbidity likely to be generated by activities associated with Prelude operations, mean that detrimental effects on mobile fauna, including demersal and pelagic fish, are not credible.

Given the widespread extent of similar habitat, the very low proportion potentially affected within the Activity Area, and the high likelihood that temporarily affected areas will recover rapidly, environmental effects will be of minimal ecological significance, with the overall residual impact consequence ranked as Slight (Magnitude: –1, Sensitivity: L).

9.6.2.2.2 Threatened, Migratory, Marine and Cetacean Species

Habitat modification is identified as a potential threat to several marine fauna species in relevant recovery plans and conservation advice (Table 7-18). Table 7-12 lists the EPBC Act listed threatened and migratory species that may occur within the Activity Area. There are no BIAs that intersect the Activity Area.

The Activity Area does not contain suitable turtle foraging or sea snake habitat (no shallow reef, shoal or bank habitat and water depths are >235 m). Therefore, seabed disturbance within the Activity Area is considered unlikely to affect marine reptiles.

Direct disturbance to the seabed represents a negligible portion of the habitat available for EPBC Act listed species. As there are no significant benthic habitat and communities to be impacted; a reduction in food sources and thus disruption to threatened, migratory, marine and cetacean species is not anticipated (Magnitude: 0, Sensitivity: M).

9.6.2.3 Socioeconomic Features

9.6.2.3.1 Fishing Industry

The Activity Area intersects the authorised fishing zones (management areas) for several commercial fisheries. However, the proportion of any of these management areas potentially affected by the highly localised and generally temporary nature of seabed disturbance associated with the activities is negligible (Magnitude: 0, Sensitivity: L).

9.6.2.4 Socioeconomic Values and Sensitivities

9.6.2.4.1 Fishing Industry

Potential impacts to the seabed, and subsequently to the associated commercially targeted fish resources—such as scampi—will be localised, and the potential impact to, and displacement of, fish is expected to be insignificant at a stock level. Therefore, it is unlikely there will be any impacts (Magnitude: 0, Sensitivity: L) to

commercial fisheries in the Activity Area from seabed disturbance, given the scale of the fisheries and the size of the Activity Area (see Figure 6-1).

9.6.2.5 Heritage and Cultural Features

No known heritage or cultural features within the Activity Area were identified during relevant persons consultation. If any are identified during ongoing consultations, the changes will be reviewed and any changes required to the EP are to be assessed and documented in accordance with the MOC process (see Section 10.4.4). The highly localised potential area affected by seabed disturbance means there will be no impacts to known heritage or cultural features (Magnitude: 0, Sensitivity: L).

9.6.2.6 Heritage and Cultural Values and Sensitivities

There are no known heritage or cultural values within the Activity Area, and none were identified during relevant persons consultation. Cosmos Archaeology (2023) predicted that the activity will not impact any tangible First Nations UCH as the infrastructure locations are located below 130 m LAT, which is the maximum extent of exposed land since humans have occupied the continent. The highly localised potential area affected by seabed disturbance means there will be no impacts (Magnitude: 0, Sensitivity: L) to heritage or cultural values from seabed disturbance.

9.6.2.7 Cumulative Impacts

When considering the absence of benthic-related BIAs and significant regional habitats within or near the Activity Area, and the limited potential extent and infrequent and short-term duration of seabed disturbance associated with IMR activities, additive and cumulative seabed disturbance effects are considered to be of minimal ecological significance and hence do not alter the assessed overall consequence level.

9.6.3 Impact Assessment Summary

Table 9-34 lists the highest residual impact consequence ranking of the relevant environmental receptor groups.

Table 9-34: Seabed Disturbance Evaluation of Residual Impacts

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Evaluation – Planned Impacts			
Protected Areas	N/A	N/A	N/A
Physical Features	N/A	N/A	N/A
Physical Values and Sensitivities	−1	L	Slight
Natural Features	−1	L	Slight
Natural Values and Sensitivities	0	L	No Impact
Socioeconomic Features	0	L	No Impact
Socioeconomic Values and Sensitivities	0	L	No Impact
Heritage and Cultural Features	0	L	No Impact
Heritage and Cultural Values and Sensitivities	0	L	No Impact

9.6.4 ALARP Assessment and Environmental Performance Standards

Table 9-35: Seabed Disturbance - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	Eliminate IMR activities	No	Subsea IMR activities (that result in seabed disturbance) are essential for maintaining the integrity of the subsea hydrocarbon system and cannot be avoided. The alternative of doing nothing would potentially compromise the integrity of the system, with increased technical risks and production failures, resulting in significant financial costs and potentially leading to increased risks of loss of containment, resulting in environmental costs.	N/A	N/A	N/A
Substitution	N/A	N/A	Substitution of seabed disturbance is not technically feasible.	N/A	N/A	N/A
Engineering	Do not use an ROV close to or on the seabed.	No	ROV operations close to or on the seabed are considered ALARP due to the water depths of the Activity Area and hence cannot be eliminated. Given the nature of the seabed, proximity of the pipeline to the seabed, disturbance from ROV operations will be negligible and implementing this control is considered technically unfeasible.	N/A	N/A	N/A
Administrative and Procedural	Prohibit vessels from anchoring in the Activity Area except in emergency events.	Yes	The procedural measure of prohibiting vessel anchoring for the activity assists in reducing seabed disturbance to ALARP.	4.1	No vessel anchoring associated with the activities, except in emergency events.	Vessel logs confirm no vessels used anchors within the Activity Area.
Administrative and Procedural	Remove all structures, equipment and property that are no longer required where safe and practicable.	Yes	All structures, equipment and property will be designed and removed, if no longer required, in accordance with Section 572 of the OPGGS Act and aligned to Section 572: Maintenance and Removal of Property Policy (NOPSEMA 2020). Implementing this control is a regulatory requirement and considered to reduce the risks to ALARP. As detailed in Section 6.10.6, when equipment is replaced, an assessment of the redundant equipment will be undertaken to evaluate the feasibility and risks associated with removal. Where removal is deemed to pose an unacceptable risk to existing operational infrastructure, redundant infrastructure items may be left in-situ. Subsea items are recorded as part of the ROV as left survey and included in the asset register. The asset register is used to track equipment to enable planning for future removal consistent with Section 10.5.13. Any redundant equipment left in-situ will be maintained in the asset register. These procedural, system, equipment and people control measures assist Shell to align with the Section 572 of the OPGGS Act.	4.2	All temporary structures, equipment and property will be designed to be retrievable and removed if no longer required. Should Prelude activities beyond the scope of this EP require temporary structures, equipment or property, they will be recorded in an asset register to facilitate future removal.	Records demonstrate that temporary structures, equipment and property are removed if no longer required or logged within an asset register.
				4.3	When subsea equipment is replaced, an assessment of the redundant equipment will be undertaken to assess the feasibility and risks associated with removal. Where removal is deemed to pose an unacceptable risk to existing operational infrastructure, redundant subsea infrastructure items may be left in-situ until such time that they can be safely removed.	Equipment recorded as part of the ROV as left survey and included in the asset register. The asset register is used to track equipment on the seabed to enable planning for future removal. Any redundant equipment left in-situ will be maintained in the asset register.
ALARP Demonstration Statement						
Based on the impact assessment outcomes and control measures adopted, Shell considers implementing the control measures appropriate to manage the potential impacts associated with activity seabed disturbance. There are no feasible additional controls identified that could further reduce the impacts. Therefore, the impacts are reduced to ALARP.						

9.6.5 Acceptability of Impacts

Table 9-36: Acceptability of Impacts – Seabed Disturbance

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Subcategory**			
Physical features, values and sensitivities	Water quality	No significant impacts to water quality. Impact not expected to result in a substantial change in water quality, which may adversely impact biodiversity, ecological integrity, social amenity or human health.	Yes	Seabed disturbance will be small scale, localised, infrequent and a small fraction of similar habitat in the region. There will be minimal impact to water and sediment quality. No significant impacts to water or sediment quality is anticipated with rapid recovery is expected. Given the offshore location and absence of particularly sensitive marine ecosystems at the FLNG location and immediate surrounds, impacts to water quality and sediment are acceptable.
	Sediment quality	No significant impacts to sediment quality. Impact not expected to result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity social amenity or human health may be adversely affected.	Yes	
Natural features, values and sensitivities	Marine bioregions	No significant impacts to benthic habitats and communities. No significant adverse impact on demersal or pelagic communities, populations, habitats or spatial distribution of a species. No substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution.	Yes	The seabed in the Activity Area is broadly distributed and not considered unique or particularly sensitive. There will be minimal impact to benthic habitats and communities and a reduction in food sources is not anticipated. Therefore, negligible impacts to demersal and pelagic species from seabed disturbance are expected.

The assessment of impacts from seabed disturbance determined the worst-case residual ranking of Slight (Table 9-34). The acceptability of the potential impacts from noise associated with the activity have been considered in the following context:

Principles of ESD

The potential impacts from seabed disturbance are consistent with the principles of ESD because:

- Seabed disturbance on such a small scale will not degrade the biological diversity or ecological integrity of the Commonwealth marine environment and therefore significant impacts to MNES will not occur.
- The health, diversity and productivity of the marine environment will be maintained for future generations.
- The precautionary principle has been applied, and studies undertaken where knowledge gaps were identified. This knowledge was applied when evaluating environmental impacts.

Relevant Requirements

Managing the potential impacts from seabed disturbance is consistent with relevant requirements, including:

- OPGGS Act:
  - Section 460(2) – a person carrying on activities in an offshore area under the permit must carry out those activities in a manner that does not interfere with the conservation of the resources of the sea and seabed to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the first person
  - Section 572 of the OPGGS Act and Section 572: Maintenance and removal of property policy (NOPSEMA 2020) – places duties on titleholders in relation to maintaining and removing the structures, equipment and property brought onto the title
- guidelines for the protection of MNES (Table 8-1)
- industry best practice.

Matters of National Environmental Significance

Seabed disturbance will not have a significant impact on MNES.

External Context

No objections or claims have been raised by relevant persons to date regarding seabed disturbance. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4

Internal Context

Shell also considered the internal context, including Shell's environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented for the activity are consistent with the outcomes from consultation for the activity and Shell's internal requirements.

Acceptability Summary

The assessment of impacts and risks from seabed disturbance determined the residual impact rankings to be Slight (Table 9-36). The acceptability of the impacts from seabed disturbance have been considered in the context of:

- the established acceptability criteria
- ESD
- relevant requirements
- MNES
- external context (i.e. relevant persons claims or objections)

- internal context (i.e. Shell requirements).

Shell considers residual impacts of Minor or lower to be acceptable if they meet legislative and Shell requirements. The discussion above demonstrates that these requirements have been met in relation to seabed disturbance.

Shell considers the potential impacts from seabed disturbance associated with the petroleum activities to be ALARP and acceptable.

9.6.6 Environmental Performance Outcomes and Measurement Criteria

EPO #	EPO	Measurement Criteria
4.1	Seabed disturbance is limited to the planned activities and those impacts described as part of the Activity, and will not occur outside the Activity Area.	Report(s) confirm ongoing subsea IMR activities associated with Prelude operations do not extend beyond the Activity Area.

9.7 Vessel Movements

9.7.1 Aspect Context

The physical presence and movement of vessels within the Activity Area presents a hazard to marine fauna that dwell at or near the sea surface, including threatened or migratory marine mammals, turtles and whale sharks, however, the abundance of such fauna in and around the Activity Area has been observed to be low. The distance of the Activity Area from the nearest areas that support seabird or shorebird roosting or nesting means there is no credible potential for disturbance due to vessel movements. Vessels may collide with marine fauna, potentially resulting in injury or death. Factors influencing the likelihood and severity of impacts from collisions include vessel type, vessel speed, water depth, the time of year and the behaviours of animals present (CoA 2017a).

The potential environmental impacts associated with the risk of collisions with other vessels are assessed in Section 9.14.

9.7.2 Description and Evaluation of Risks

Table 9-37 indicates the environmental features and values and sensitivities that have been identified to be potentially affected by vessel movements during the activities covered by this EP, with further evaluation of each potentially affected receptor category provided in Section 9.7.2.1. Features or values and sensitivities which could not be credibly affected are not discussed further. As outlined in Section 9.2.4, the assessment considers only the residual risks following the application of controls.

Table 9-37: Vessel Movements Receptor Impact Screening Summary

	Protected Areas			Features														Values and Sensitivities																							
				Physical		Natural				Socioeconomic							Heritage and Cultural			Physical				Natural									Socioeconomic							Heritage and Cultural		
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect																																								

Legend:		Potentially affected
	×	Predicted impact

9.7.2.1 Natural Features, Values and Sensitivities

9.7.2.1.1 Timor Province Bioregion

Vessel movements can result in collisions between the vessel (hull and propellers) and pelagic marine fauna, potentially resulting in superficial injury, serious injury that may affect life functions (e.g. movement, reproduction), or death. Smaller marine fauna are also at risk of injury or death if caught in thrusters used for DP during station keeping operations, and/or via entrapment in vessel water intakes.

There are no aggregation sites for marine fauna within the Activity Area and the pelagic species that may be affected by vessel movements have widespread distributions in the bioregion. The number of individuals of any marine fauna species that may be affected is low, representing a negligible proportion of its regional population and therefore no impacts on pelagic (or any) communities within the region are anticipated (Likelihood: Extremely Remote A, Consequence: No impact, Residual Risk: Light Blue).

9.7.2.1.2 Threatened, Migratory, Marine and Cetacean Species

The Activity Area does not contain and is not near any aggregation sites for threatened or migratory species. There are no identified BIAs or critical habitats within the Activity Area with the closest such areas located 23 km away for turtles, 17 km away for whale sharks and 78 km for marine mammals. The abundance of threatened or migratory species in the Activity Area is expected to be low and their presence transient.

In the event of vessel/fauna collision, the severity of injury is influenced by vessel speed—the greater the speed on collision, the greater the risk of death (Jensen and Silber 2004; Laist et al. 2001). Vessels at/near the facility or undertaking IMR activities will generally be stationary or very slow moving (<8 knots), reducing both the risk of collision and the impact if collision occurs. The risk of megafauna getting caught in operating thrusters or water intakes is considered to be very low, given the size of individuals, combined with their likely avoidance of DP operations due to factors such as noise emissions. Therefore, the risk of adverse impact through fauna collision during vessel movements relates primarily to vessels transiting to/from the facility.

Given the low density of EPBC Act listed species within the Activity Area, the relatively small area within which collisions could occur, the typically low vessel speeds and generally low number of vessel movements associated with the Activity, the worst-case consequences are considered to be Minor (Likelihood: Unlikely C, Consequence: Minor, Residual Risk: Dark Blue).

Marine Mammals

The marine mammals that may occur within the Activity Area include cetaceans and sirenians. There are no identified BIAs for marine mammals within the Activity Area and the numbers of any species of cetaceans or sirenians that may coincide with the presence of a transiting vessel are expected to be very low. Several cetaceans (including pygmy blue, humpback, sei, fin, and Bryde's whales) are identified as potentially occurring within the area (see Section 7.7.1), with several sightings of pygmy blue and humpback whales from the Prelude FLNG having been previously reported.

Of the species that may occur, whales are expected to be the most vulnerable to vessel collisions due to their large size and the relatively high proportion of time they spend at or near the sea surface. Jensen and Silber (2004) base the likelihood and consequence of vessel collisions with whales by both vessel size and speed; the greater the speed at impact, the greater the risk of mortality (Laist et al. 2001). Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale as a result of a vessel strike increases from 20% at 8.6 knots to 80% at 15 knots. According to the data of Vanderlaan and Taggart (2007), it is estimated that the risk is less than 10% at a speed of 4 knots. Although dolphins are at much lower risk from collision due to their small size, manoeuvrability and echolocation abilities compared to whales, they are still included in this assessment given they surface to breathe and are known to feed near the surface at times.

Vessels will be required to comply with the EPBC Regulations 2000 (Part 8) within the Activity Area, including adhering to no approach zones (within vessel navigation safety limits), and not exceeding 6 knots if/where a whale or dolphin is observed in proximity to the vessel. Vessels will generally travel at low speeds (<8 knots) in the vicinity of infrastructure.

Given the relatively low frequency of vessel movements that may involve elevated speeds or large vessels, and the low inherent probability of a marine mammal occurring near the surface within a transiting vessels route (and draught), the likelihood of collisions causing injury or death of an individual marine mammal and

resulting in Minor consequences to threatened or migratory species is considered to be Unlikely (Likelihood: Unlikely C, Consequence: Minor, Residual Risk: Dark Blue).

Marine Reptiles

The Activity Area does not represent important habitat for marine turtles, being distant from emergent land with water depths (~250 m) that are deeper than typical foraging dives by marine turtles (e.g. Hays et al. 2001; Polovina et al. 2003) or sea snakes given the absence of shallow reefs or shoals. Therefore, the presence of marine reptiles within the Activity Area is likely to be restricted to relatively low numbers of individuals transiting the area. The risk of collisions between turtles and vessels increases with vessel speed (Hazel et al. 2007). The typical response from turtles on the surface to the presence (including noise) of vessels is to dive (a potential 'startle' response), which decreases the risk of collisions (Hazel et al. 2007). Given the speed restrictions on vessels operating in the Activity Area, combined with the expected low numbers of turtles and sea snakes in the area, the likelihood of collisions between vessels resulting in Minor consequences is assessed as Unlikely (Likelihood: Unlikely C, Consequence: Minor, Residual Risk: Dark Blue).

Sharks and Rays

There are no identified BIAs for sharks or rays within the Activity Area, however, whale sharks have been observed traversing the area. It is expected that whale shark presence would not comprise of significant numbers given there is no main aggregation area within the vicinity, and their presence would be transitory. The probability of collision impacts to other populations of threatened or migratory sharks and rays that may occur in the Activity Area is considered very low given their generally high mobility, behaviour patterns and the absence of habitat features that might support substantive numbers of any species.

Whale sharks are expected to be the most susceptible to vessel strikes due to their tendency to spend time near the surface, particularly when feeding (Womersley et al. 2022). Whale sharks are at greatest risk of mortality from vessel strikes through interactions with fast moving, large vessels (>300 t) with smaller and/or slower moving vessels more likely to result in survivable injuries (Womersley et al. 2022). The Conservation Advice for the whale shark (DoE 2015e) lists strikes from large vessels as a threat, although the Species Profile and Threats Database for this species (DoE 2024a) indicates there are no substantial current threats in Australian waters.

Given the typically low speeds of vessel movements associated with the activity, the temporary and generally infrequent nature of vessel movements, and the low numbers of any threatened or migratory species of sharks or rays that might be impacted, the likelihood of Minor impact consequences is considered to be Unlikely (C).

Therefore, overall, the residual risk to threatened, migratory, marine and cetacean species from vessel movements is assessed as Dark Blue (Likelihood: Unlikely C, Consequence: Minor, Residual Risk: Dark Blue), (Table 9-38).

9.7.3 Impact Assessment Summary

Table 9-38: Vessel Movement Evaluation of Residual Risk

Environmental Receptor	Consequence	Likelihood	Residual Risk
Evaluation – Unplanned Risks			
Protected Areas	N/A	N/A	N/A
Physical Features	N/A	N/A	N/A
Physical Values and Sensitivities	N/A	N/A	N/A
Natural Features	No Impact	A	Light Blue
Natural Values and Sensitivities	Minor	C	Dark Blue
Socioeconomic Features	N/A	N/A	N/A
Socioeconomic Values and Sensitivities	N/A	N/A	N/A
Heritage and Cultural Features	N/A	N/A	N/A

Environmental Receptor	Consequence	Likelihood	Residual Risk
Heritage and Cultural Values and Sensitivities	N/A	N/A	N/A

9.7.4 ALARP Assessment and Environmental Performance Standards

Table 9-39: Vessel Movements - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	Eliminate any unnecessary vessel movements.	No	The number of vessels used is already considered minimal. Any fewer vessels will not meet operational needs.	N/A	N/A	N/A
Engineering	None identified.	N/A	No appropriate control measures have been identified to reduce collision likelihood through engineering means.	N/A	N/A	N/A
Administrative and Procedural	Vessels comply with EPBC Regulations 2000 Part 8, Division 8.1 Interacting with Cetaceans.	Yes	The EPBC Regulations 2000 – Part 8 Division 8.1 (Regulations 8.05 and 8.06) are recognised as the industry standard for minimising disturbance due to physical presence to whales and dolphins and will be applied to other species as relevant (i.e. turtles, whale sharks). Implementing this administrative and procedural control measure is based on legislative requirements and hence adopted to ensure compliance with legislation.	3.1	Vessel interactions with EPBC listed species to follow the EPBC Regulations 2000 – Part 8 Division 8.1 (Regulations 8.05 and 8.06). In particular: • Vessels will not deliberately approach closer than 50 m to a dolphin, turtle or whale shark; 100 m for an adult whale; 300 m for a whale calf; and 150 m for a dolphin calf. • If the whale, dolphin, turtle, or whale shark shows signs of being distressed, vessels will immediately withdraw from the caution zone at a constant speed of ≤6 knots (except in emergency conditions or when manoeuvring is not possible).	Vessel reports demonstrate adherence to EPS 3.1 requirements. Incident report form used to record breaches of requirements outlined in the EPBC Regulations 2000.
Administrative and Procedural	Dedicated Marine Fauna Observers on all vessels.	No	The cost to have dedicated trained MFOs on vessels represents a disproportionate cost due to the low environmental risk given the other controls adopted.	N/A	N/A	N/A
ALARP Demonstration						
Based on the impact assessment outcomes and control measures adopted, Shell considers implementing the control measures appropriate to manage the potential impacts associated with vessel movements. No additional or alternative controls were identified that could further reduce the impacts without disproportionate effort and cost. Therefore, the impacts are considered to be reduced to ALARP.						

9.7.5 Acceptability of Risks

Table 9-40: Acceptability of Risks – Vessel Movements

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Sub-category**			
Natural features, values and sensitivities	Threatened, migratory, marine and cetacean species.	No mortality or injury of cetaceans. Management of aspects of the activity must align with conservation advice, recovery plans and threat abatement plans (Table 8-1). No significant impacts to EPBC Act listed threatened, migratory, marine or cetacean species.	Yes	The assessment of potential impacts to fauna from vessel strike and the controls on vessel movements and speeds are considered to be aligned with conservation actions outlined in the relevant conservation advice, recovery plans and threat abatement plans. With the proposed extension in application of EPBC Regulations 2000 – Part 8 to turtles and whale sharks the potential risk of injury or mortality to threatened fauna has been reduced to ALARP and acceptably low levels and no significant impacts to EPBC Act listed species is predicted.

The assessment of risks from vessel movements determined the residual ranking of Dark Blue (Table 9-38), deemed as inherently acceptable. The acceptability of risks to marine biota from vessel movements associated with the petroleum activities has been considered in the following context.

Principles of ESD

The potential risks from vessel movements are consistent with the principles of ESD because:

- The vessel movements aspect does not degrade the biological diversity or ecological integrity of the Commonwealth Marine Area in the Browse Basin. Significant impacts to MNES are highly unlikely.
- The health, diversity and productivity of the marine environment will be maintained for future generations.
- The precautionary principle has been applied, and studies undertaken where knowledge gaps were identified. This knowledge has been applied during the evaluation of environmental risks.

Relevant Requirements

Managing the potential risks of impacts from vessel movements is consistent with relevant requirements, including:

- Vessel interactions with cetaceans to follow the EPBC Regulations 2000 – Part 8 Division 8.1 (Regulations 8.05 and 8.06) and the Australian National Guidelines for Whale and Dolphin Watching 2017 (DoEE 2017), with additional requirements applied for turtles and whale sharks, including:
  - Vessels will not deliberately approach closer than 50 m to a dolphin, turtle or whale shark; 100 m for an adult whale; 300 m for a whale calf; and 150 m for a dolphin calf
  - If the whale, dolphin, turtle or whale shark shows signs of being distressed, vessels will immediately withdraw from the caution zone at a constant speed of ≤6 knots (except in emergency conditions or when manoeuvring is not possible)
- Policies, strategies, guidelines, conservation advice, and recovery plans for threatened species (see Table 9-41).

Matters of National Environmental Significance

Threatened and Migratory Species

The evaluation of risks indicates significant impacts to threatened and migratory species will not credibly result from the vessel movements aspects of the petroleum activities.

An unplanned collision between a vessel and threatened or migratory fauna is unlikely to occur, however, if it does occur, it may result in injury to or death of an individual animal. This unplanned event is not considered to have the potential for significant impacts to threatened or migratory species at the population level.

Table 9-41 summarises alignment with management plans, recovery plans and conservation advice for threatened and migratory fauna.

Commonwealth Marine Environment

The potential impacts and risks from the vessel movements aspect of petroleum activities on the Commonwealth marine environment will not credibly exceed any of the significant impact criteria, as listed in Table 8-1, as such, it is considered that the aspect does not pose a credible risk to the Commonwealth marine environment.

Table 9-41: Summary of Alignment with Relevant MNES Considerations

MNES	MNES Acceptability Considerations	Demonstration of Alignment
Threatened and Migratory Species – Marine Mammals	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1).	The risk assessment indicates that the likelihood of vessel collisions with threatened or migratory marine mammals is considered unlikely, and the consequence of any such collision would be restricted to an individual animal. As such, the petroleum activities do not exceed any of the significant impact criteria for threatened and migratory marine species as listed in Table 8-1.
	National Strategy for Reducing Vessel Strikes on Cetaceans and other Marine Megafauna (CoA 2017a).	Vessel movements will be aligned to 'Objective 3: Mitigation' of the National Strategy by: • maintaining separation of vessels and whales. • maintaining slow vessel speeds; and • avoidance manoeuvres. This will be met by the vessels adhering to Part 8 (Interacting with cetaceans and whale watching) of the EPBC Regulations. Note the other objectives of the Strategy relate to actions for Government agencies.
	Approved Conservation Advice *Balaenoptera borealis* (sei whale) (DoE 2015c).	The risk of vessel strikes will be managed by adhering to the EPBC Regulations 2000 – Part 8 Division 8.1 (Regulations 8.05 and 8.06).
	Conservation advice on fin whale (Balaenoptera physalus) (DoE 2015d).	
	Conservation management plan for the blue whale: A recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999 2015-2025* (CoA 2015a).	
	Conservation advice on humpback whale (Megaptera novaeangliae) (DoE 2015b).	
Threatened and Migratory Species - Marine Reptiles	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1).	The risk assessment indicates that the likelihood of vessel collisions with threatened or migratory marine reptiles is considered remote, and the consequence of any such collision would be restricted to an individual animal. As such, the petroleum activities do not exceed any of the significant impact criteria for threatened and migratory marine species, as listed in Table 8-1.

MNES	MNES Acceptability Considerations	Demonstration of Alignment
	Recovery Plan for Marine Turtles in Australia 2017-2027 (CoA 2017b).	Vessels colliding with turtles is considered unlikely due to the offshore location (and resultant low densities of turtles), slow speeds of vessels and diving startle response of turtles. Furthermore, the risk of a vessel collision with a turtle will be further reduced by implementing EPBC Regulations 2000 – Part 8 Division 8.1 (Regulations 8.05 and 8.06).
	Approved conservation advice for *Dermochelys coriacea* (Leatherback Turtle) (TSSC 2008a).	
Threatened and Migratory Species - Sharks and Rays	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1).	The risk assessment indicates that the likelihood of vessel collisions with threatened or migratory sharks and rays is considered remote, and the consequence of any such collision would be restricted to an individual animal. As such, the petroleum activities do not exceed any of the significant impact criteria for threatened and migratory marine species, as listed in Table 8-1.
	Conservation Advice on whale shark (*Rhincodon typus*) (DoE 2015e).	The Activity Area is not recognised as a BIA or habitat critical to the survival of whale sharks. The Conservation Advice recommends minimising offshore developments close to marine features that may aggregate whale sharks and cites Ningaloo Reef and Christmas Island as examples. Studies of whale sharks tagged while aggregating at Ningaloo Reef have shown individuals transiting through the Timor Sea (Meekan & Radford 2010) but showed no evidence of aggregation around particular marine features in the open offshore waters within or near the Activity Area.
Commonwealth Marine Environment	Significant impact guidelines for the Commonwealth marine environment (Table 8-1).	The impact assessment indicates that any impacts from vessel movements are predicted to not exceed the Commonwealth marine environment significant impact criteria as listed in Table 8-1; as such it is considered that the aspect does not pose a credible risk to the Commonwealth marine environment.

External Context

No objections or claims have been raised by relevant persons to date regarding vessel movements. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4.

Internal Context

Shell also considered the internal context, including Shell's environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented, are consistent with the outcomes from consultation for the petroleum activities and Shell's internal requirements.

Acceptability Summary

The acceptability of the associated risks from vessel movements have been considered in the context of:

- the established acceptability criteria
- ESD
- relevant requirements
- MNES
- external context (i.e. relevant persons claims/objections)
- internal context (i.e. Shell requirements).

The residual risks have been assessed as Dark Blue (Minor). Shell considers residual risks of minor or lower to be acceptable if they meet legislative and Shell requirements. The discussion above demonstrates that these requirements have been met in relation to the vessel movements.

Shell considers the risks to marine biota from vessel movements associated with the activity to be ALARP and acceptable.

9.7.6 Environmental Performance Outcome

EPO #	EPO	Measurement Criteria
2.1	No injury or mortality of threatened, migratory or cetacean species associated with the Activities.	Reports of injury or mortality of EPBC listed threatened, migratory or cetacean species associated with the Activities sent to NOPSEMA and DCCEEW in accordance with requirements outlined in Table 10-13.

9.8 Introduction of Invasive Marine Species

9.8.1 Aspect Context

Invasive Marine Species (IMS) are non-indigenous marine fauna or flora that have been introduced into an area beyond their natural geographical range, and may have the ability to survive, reproduce and establish a population such that they threaten native species through increased competition for resources and/or increased predation.

The vessels and some of the subsea equipment (e.g. ROVs) used during the activity have the potential to introduce or translocate IMS within the Activity Area. There are two primary mechanisms which may cause the inadvertent introduction and spread of IMS; hull fouling (biofouling) and ballast water discharges. Successful IMS colonisation requires these stages (Marine Pest Sectoral Committee 2009):

- the potential IMS must be present on (e.g. biofouling) or in (e.g. ballast water) the vector
- the potential IMS must be released into the environment (e.g. ballast water discharge, release of propagules from biofouling)
- the potential IMS must survive, reproduce (either sexual or vegetative reproduction) and subsequently persist in the environment.

The introduction of IMS is recognised globally as a threat to marine biodiversity, and the IMO has developed guidelines for the management of biofouling and ballast water. Commonwealth, State and Territory authorities also regulate the risk of IMS from biofouling and ballast water. Vessels operating in Australia are required to meet these requirements, and vessels meeting these requirements pose an inherently lower risk of harbouring IMS or releasing IMS into the environment.

During the activity, support vessels, tankers and vessels associated with IMR/Turnaround activities will transit to and from the Activity Area. Many of these vessels are expected to be already operating in WA waters but some may have arrived from interstate/territory or international ports. Requirements to discharge ballast water in the Activity Area are expected to be limited, however, all operational vessels are subject to marine fouling whereby organisms attach to the vessel hull, particularly if/when vessels spend time stationary (e.g. in ports) and in areas of the vessel where organisms can readily attach (e.g. seams, strainers, unpainted surfaces, sea chests). If IMS become established in the Activity Area, such as on the Prelude FLNG, vessel movements may subsequently provide vectors for translocation to new areas (NOPSEMA 2024) or increase the impact of IMS already established in the wider region (DoF 2017). The likelihood of this sequence of events is considered extremely remote given the controls that are routinely applied to vessels (e.g. anti-fouling coating, inspections, hull cleaning etc.), the remote offshore location and nature of typical vessel activities (e.g. short periods alongside the Prelude FLNG during operations).

The Prelude FLNG facility will take up and discharge ballast water regularly as it produces cargoes and exports the products to offtake tankers, but this ballast water does not pose a credible threat as the FLNG facility is permanently moored and does not travel to or from other ports. Support vessels will generally come from Australian ports and typically stay alongside the Prelude FLNG for short durations (generally in the order of hours) to offload and load materials.

Most native fouling species likely to be encountered within the Activity Area are widely distributed as similar habitats are broadly represented in the Timor Sea and Browse Basin. An IMS may compete with these native species if it were to become established in the Activity Area or wider region. This may decrease the species diversity of benthic communities. Typically, IMS are extremely difficult to eradicate once established and reproducing in an area.

All known and potential introduced marine pests listed by Australian agencies are nuisance foulers, predators, invasive seaweeds or noxious dinoflagellates and tend to inhabit ports, harbours, embayments, estuaries, shorelines and shallow coastal waters, although some species can survive in waters up to 200 m deep (Hayes et al. 2004, Barry et al. 2006). The risk of an IMS being able to successfully establish itself will depend on the depth of water (the water depth in the Activity Area is >235 m), distance from the coast, water movement and latitude. The probability of successful IMS settlement and recruitment decreases in well-mixed, deep ocean waters away from coastal habitats. An IMS travelling through several latitudes also must survive significant temperature and salinity changes.

The relatively deep, oligotrophic (nutrient-poor) oceanic waters of the Activity Area and general lack of hard seabed reduces the potential for successful settlement and establishment of an IMS in the unlikely events of being released in the Activity Area.

9.8.1.1 Current Knowledge about IMS on Prelude FLNG

Various studies were conducted both prior to and after the Prelude FLNG arrived in the Activity Area in July 2017, which provides more certainty on the presence/absence or persistence of potential IMS. A detailed summary of the outcomes and timing of various monitoring measures is outlined below. **Pre-arrival** of Prelude FLNG in the Activity Area, 'ALARP Cleaning' (April - June 2017) was conducted in the Geoje shipyard to reduce IMS numbers and potential inoculum pressure (and was considered the best practicable risk management outcome available). Specific to biofouling management, Shell contracted biofouling specialists to provide advice on the clean-up required as well as inspection services. Biofouling experts have produced the following reports for Prelude pre-mobilisation:

- International Anti-Fouling System Certificate from Lloyds Register.
- **IMS Risk Assessment (BFS1445)** – Assessed the risk of Prelude FLNG introducing IMS of concern to Australian waters. The risk assessment is based on "Infection Modes and Effects Analysis" (IMEA) for two IMS management scenarios: 1) Do nothing, and 2) ALARP. The study indicated that ALARP cleaning could vastly reduce IMS numbers and potential inoculum pressure and was considered the best practicable risk management outcome available.
- **Biofouling Management Plan (BFS1456)** – Outlined the proposed biofouling removal measures from the FLNG.
- **Biofouling/IMS Mitigation and Final Inspection (BFS1476)** – Final inspection report after biofouling removal in Geoje, and the assessment of the residual IMS Risk. The cleaning effort of the hull achieved a significant reduction in the number of IMS of concern and their cumulative reproductive potential. Despite residual risk, significant level of effort was applied in the in-water cleaning campaign. (Biofouling Solutions 2017a)

Post-arrival of Prelude FLNG in the Activity Area (July 2017) until December 2019, four ROV surveys and one set of eDNA sampling campaign were conducted, with data reviews from the biofouling experts. The updated residual risk assessment was developed in consultation with IMS agencies (i.e. DPIRD, NT Fisheries, Department of Agriculture, Water and the Environment (DAWE) after the first post-arrival ROV survey to agree on an aligned approach to managing IMS risk and the ongoing adaptive IMS risk management process. The Prelude FLNG Biosecurity Management Plan (2000-010-G000-GE00-G00000-HX-5798-00003) has been updated upon new information and understanding of the IMS residual risk.

- **Prelude ROV Inspection Report (BFS1499)** - the IMS Inspector noted the presence of *S. clava, C. intestinalis*, suspected *Magallana gigas* (formerly *Crassostrea gigas)* and *D. vexillum* persisting amongst inaccessible and/or uncleaned areas. IMS of concern which had been detected during previous inspections or any additional IMS of concern which may be present within Korean waters, remained undetected. The *Didemnum* sp. present resembled *D. perlucidum*, the introduced colonial ascidian to Western Australia. This is not surprising considering the species were confirmed on two other installations in the area (i.e. the ROV survey and physical sample results post arrival of the neighbouring Ichthys facilities). (Biofouling Solutions 2017b)
- **eDNA water sampling report from Trace and Environmental DNA (TrEnD) Laboratory at Curtin University** - No IMS of Concern detections in the categories 'highly probable', 'probable' or 'possible'. However, the presence of *Crassostrea virginica, Mnemiopsis leidyi, Pseudo-nitzschia seriata* and *Gymnodinium catenatum* were considered inconclusive. (Curtin University 2018)

To provide additional context to the studies listed above, Biofouling Solutions undertook a residual risk assessment (Biofouling Solutions 2018). The report presented a residual risk assessment including new information from two ROV inspections (2017 and 2018) and eDNA water sampling undertaken by Shell at the recommendation of WA DPIRD. Water samples were collected from the moonpool and internal seawater systems via sea strainers on the FLNG. While DNA was successfully extracted from all samples collected, the yields of DNA were reported as being low (relative to seawater). Unfortunately, this could be a consequence of the water samples being collected from internal seawater systems where sodium hypochlorite is

continuously dosed into each sea chest. DNA degradation could also have occurred during the transit of samples to the laboratory.

Nevertheless, the eukaryotic nuclear 18S gene (V1-V3) was amplified according to the TrEnD Lab's standard operating procedures and the DNA sequences recovered were queried against a custom database of marine invasive species reference sequences and compared to the National Centre for Biotechnology Information (NCBI) database for taxonomic identification to family level.

The results of the eDNA study detected a diverse range of taxa. Potential IMS detections were screened as either of the following categories; Highly Probable, Probable, Possible or Inconclusive. From the eDNA samples collected, no IMS of concern were detected in the Highly Probable, Probable or Possible categories.

The presence of four species were screened as Inconclusive. These included *Pseudo-nitzschia seriata* and *Gymnodinium catenatum* that are species of toxic dinoflagellates which only cause concern when they form toxic blooms. These blooms are often linked to increased stress such as excessive pollution or nutrient runoff. The distribution of *G. catenatum* in Australian waters is uncertain and species in the genus *Pseudo-nitzchia* are frequently present throughout Australian waters. The presence of these species is unable to be fully determined using only 18S sequences, as they cannot be distinguished from other closely related taxa.

The Biofouling Solutions (2018) report concluded that the results of the eDNA study were not reliable. This was because the water samples were collected from internal seawater systems which contained sodium hypochlorite which is known to influence eDNA analysis. Other factors included that not all native and IMS species of concern have been sequenced and are available on the NCBI database and that eDNA cannot distinguish between live and dead cells. Finally, it was concluded that the detection of a species does not necessarily mean that they originated from the FLNG and could originate from other sources (such as ballast water discharges from other international vessels).

Another important point is that while the eDNA results detected the Phylum Chordata, unfortunately the 18S assay does not bind to *Didemnum* spp., such as *D. perlucidum* or *D. vexillum*, hence this technique cannot be used for reliable detections. Furthermore, Curtin University were advised by Dr. Justin McDonald of WA DPIRD, that *D. perlucidum* is now so widespread throughout Western Australia that it does not need to be reported to the WA DPIRD, hence Curtin University did not pursue further testing of this genus.

The outcome of the residual risk assessment undertaken by Biofouling Solutions (2018) reported that as of July 2018 there were five IMS of concern that have either been confirmed and/or have the potential to be present on the FLNG (*Amphibalanus eburneus, Codium fragile, Didemnum perlucidum* (unconfirmed), *Magallana gigas* and *Pseudo-nitzschia seriata).* The report further considered the potential for natural spread and artificial spread via domestic conveyances, where such transportation incorporates a series of stages along an invasion pathway. In the case of the FLNG such a pathway constitutes a two-stage stepping-stone process whereby visiting domestic conveyances become contaminated during an interaction with the FLNG, followed by the subsequent transfer of viable individuals from the domestic conveyance to high value areas and/or inshore coastal waters of Australia. The likelihood of these stepping-stone events occurring depends on a multitude of variables including the size of the population of IMS of concern on the FLNG, the reproductive biology and maturity of the IMS of concern, their larval phenology, the ability of the species to transfer asexually or even via entanglement, the environmental conditions experienced during the interactions, the duration and frequency of the interactions, and the availability of appropriate habitat for larvae or fragments to colonise or be entrained. The interaction of these (and other) variables is extremely complex and results in a highly stochastic probability of transfer which makes it extremely difficult to make any meaningful likelihood assessment beyond a broad consideration of plausibility.

In the event that domestic conveyances were to become contaminated with IMS of concern via settlement on the external hull or entrainment within internal seawater systems (including ballast water) from the FLNG, the likelihood of these species being successfully translocated to high value areas and/or inshore coastal waters of Australia depends on a whole suite of new selective filters such as the vessel's frequency, duration and distance, environmental conditions, proximity and suitability of habitats, (especially artificial substrates), etc. Biofouling Solutions (2018) concluded that the likelihood of IMS of concern being successfully introduced from the FLNG to either high value areas or inshore coastal waters via domestic conveyances is considered to be very low for all five IMS of concern. Although one species (*Didemnum perlucidum* which may be present on the FLNG but remains unconfirmed, has the greatest likelihood of being both naturally spread or artificially

transmitted from the FLNG to high value areas such as Browse Island (approximately 42 km from Prelude). If this species were to be introduced to a high value area, it has a theoretical potential to cause moderate impacts/ consequences. Similarly, *Pseudo-nitzschia seriata* also has the potential to cause moderate impacts if introduced into the inshore coastal waters of Australia.

Based on the uncertainty following the eDNA study (2018), further additional ROV inspections were undertaken in 2018 and 2019 as listed below.

- **Prelude ROV Inspection interpretation** – An ROV survey was conducted on the Prelude hull 12-13 November 2018. IMS expert reviewed the results and updated the specific residual risk of IMS species. Outcomes of the review indicated that there was no evidence to suggest the presence of the IMS of concern, *Didemnum vexillum.* The survey also confirmed the consistent mortality of *Magallana* spp. since the arrival of the FLNG in the Activity Area this is because the genus is beyond its temperature and reproductive tolerance and will slowly die out given there is unlikely to be fresh recruitment. The IMS expert review identified a morphologically similar growth resembling *Didemnum* to be present on the general hull and on sea chest gratings. However, whether this growth is in fact *D. perlucidum* can only be confirmed via sample collection and genetic testing. *Pseudo-nitzschia seriata, Gymnodinium catenatum and Codium fragile fragile* were all not observed during the latest and previous post arrival ROV surveys. *Amphibalanus eburneus* (acorn barnacle) may persist in turret area. Although in order for species to persist, individuals need to be in high abundance and within close proximity in order to cross-fertilise. Even if they do reproduce, the competency period of larvae is too long to enable an F2 generation to re-establish on the hull, hence all individuals are likely to die of old age over time.

  Based on the December 2018 IMS expert review of the survey data available, individual IMS of concern's residual risk of being transmitted to high value areas or inshore waters of Australia were deemed to be Moderate or lower which corresponds to a risk ranking of Dark Blue in Table 9-43. This assessment was subsequently reviewed by NT DPIRD and WA Department of Fisheries in February 2019 and the outcome of the residual risk assessment was aligned.

- **Prelude ROV Inspection Report (BFS1629)** - An ROV survey was conducted on the Prelude hull 19 September 2019. Overall, the assemblages of biofouling observed by the IMS expert on the FLNG were moderately diverse and abundant, varying from 40-100% coverage and were typical of biofouling communities associated with offshore structures located in the Northwest Shelf region of Western Australia. Observations of paint conditions show that the anti-foul coating is generally in good condition though significant delamination/damage was observed in one location. The report concluded "*no IMS of concern when reviewing the footage but did observe that white colonial ascidians with a colony structure and basic morphology resembling colonial ascidians of in the genus Didemnum were widely distributed on the vessel. This group includes Didemnum perlucidum which is considered an IMS but is now confirmed to be widely distributed throughout Western Australian coastal waters*." Although the species is no longer considered a noxious pest in Western Australian waters with the exception of the Montebello Islands. (Biofouling Solutions 2019).

- **Prelude ROV Inspection Report (BFS1797)** – An ROV structural integrity inspection survey was conducted on the Prelude hull in May-June 2022 and subsequently assessed for IMS. The survey was significantly more thorough in scope compared to past ROV inspections, covering port, starboard and transom aspects of the hull as well as the thrusters, sea chests, cathodic protection systems and seawater discharges. It was observed that the antifouling coating is still performing "*exceptionally well, with biofouling being limited to predominantly filamentous green algae and gooseneck around the waterline",* although biofouling was still observed around the hull. Cream-coloured sponges and white colonial ascidians were found on some sea chest gratings; however, it was concluded that these were highly unlikely to be *D. perlucidum* given the lack of detection across the hull; moreover *D. perlucidum* as an established IMS is no longer being managed by regulations. A number of oysters were observed that appeared to resemble *Magallana gigas,* the Pacific oyster which had survived the voyage to site but mostly died off due to local water temperatures. It was not able to be concluded if they were alive but was noted that it is "*unlikely the species could produce a self-sustaining established population on the Prelude FLNG or surrounding environment*."

The ROV inspections and the eDNA studies to date confirm that the likelihood of the FLNG as a source of introducing IMS of concern is very low based on either natural or artificial transfer to new areas, with no IMS of concern on the Prelude hull since arrival in field in 2017.

9.8.2 Description and Evaluation of Impacts and Risks

Table 9-42 indicates the environmental features and values and sensitivities that have been identified to be potentially affected by the introduction of IMS during the activities covered by this EP, with further evaluation of each potentially affected receptor category provided in Sections 9.8.2.1 to 9.8.2.4. Features or values and sensitivities which could not be credibly affected by IMS are not discussed further.

The consequences for any given receptor of IMS establishing in the marine environment may vary considerably depending on a number of factors, including the characteristics of the IMS involved, the vulnerability of the receptor to impacts from those characteristics, and the interactions. However, in a worst-case the establishment of marine pests may result in significant impacts to the marine environment, potentially causing widespread ecological changes and/or compromising the viability of socio-economic, or heritage values associated with environmental resources. Therefore, for the purposes of risk assessment Shell has conservatively assumed that the establishment of IMS in the Activity Area would have potentially Major consequences for all affected receptors.

Table 9-42: Introduction of IMS Receptor Impact Screening Summary

	Protected Areas			Features																	Values and Sensitivities																				
				Physical		Natural				Socioeconomic								Heritage and Cultural			Physical				Natural							Socioeconomic							Heritage and Cultural		
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect																																									

Legend:		
		Potentially affected
	×	Predicted impact

9.8.2.1 Protected Areas

9.8.2.1.1 Marine Conservation Reserves

The nearest AMPs, Kimberley and Cartier Island, are ~113 km and ~134 km, respectively away from the facility. Direct introduction of IMS to these areas is therefore not credible. For IMS to impact the values of AMPs, a species would need to be introduced to the Activity Area, become established and reproduce in the Activity Area, and then be translocated to an AMP and successfully establish and spread in the AMP. Within the context of potential sources of IMS associated with the activity and the controls in place to minimise the potential for IMS to be translocated by activities covered by this EP, introduction of IMS to the Activity Area is highly unlikely. Given that the water depths and substrates within the Activity Area are very different to those within the Kimberley AMP and at Cartier Island, and the separation distances to these areas, the likelihood of IMS being introduced and establishing viable populations within an AMP is considered Remote (Likelihood: Remote B, Consequence: Major, Residual Risk: Yellow)

9.8.2.2 Natural Features, Values and Sensitivities

9.8.2.2.1 Timor Province and Northwest Shelf Transition Bioregions

Benthic communities are the natural features most at risk from IMS. If IMS are introduced into a new area that can support their needs, they can reproduce and establish a population in that area. In addition to affecting biodiversity in the immediate area, newly established populations of IMS can spread to nearby areas because many IMS produce larval stages that can be transported by ocean currents. The introduction and subsequent establishment of IMS could result in changes to the structure of benthic communities leading to a change in ecological function due to predation of native marine organisms and/or competition for resources.

Benthic communities within the Activity Area are characterised by low-density macrobenthic communities of deposit feeders and filter-feeders on bare sediments. The seabed within the Activity Area does not receive sufficient sunlight to support benthic primary producer habitat, such as macroalgae and zooxanthellate corals.

In the unlikely event that IMS species were introduced into the Activity Area, they would not be expected to survive or become established on benthic substrates. Based on the information within the Australian Marine Pest Monitoring Manual (DAFF 2010), very few IMS (aside from planktonic oceanic species such as dinoflagellates) could credibly survive in the deep waters of the Activity Area. The few species (e.g. European clam and Northern Pacific seastar) that can potentially survive in deep waters (up to 200 m) are generally unable to settle and establish successfully in deep–water ecosystems (Geiling 2014), most likely due to a lack of light and suitable habitat (e.g. hard substrate for attachment and nutrient-poor water) to sustain growth and survival. Therefore, most IMS are found in tidal and subtidal zones, with only a few species known to extend into deeper waters of the continental shelf (Bax et al. 2003). Most IMS introduced (via ballast water) to an area outside of their natural range will not survive to establish or subsequently become invasive or a pest (Wells et al. 2024).

With the stated controls in place, the likelihood of introducing IMS that could establish and impact benthic communities is considered Extremely Remote (Likelihood: Extremely Remote, A Consequence: Major, Residual Risk: Dark Blue).

9.8.2.2.2 Shoals and Banks; Offshore Reefs and Islands

Shoals and banks in the region are shallower than the Activity Area and may therefore be more vulnerable to introduction of IMS, although the shoals and banks are generally beyond the preferred depth range of many potential IMS and translocation from the Activity Area would require spread across open areas of deep water.

The closest reef or island is Browse Island which is located ~42 km from the facility. The nearest shoals or banks, Echuca and Heyward Shoals, are located ~62 km and 84 km from the facility, respectively. Direct introduction of IMS to these areas is therefore not considered to be credible. Given that the water depths and substrates within the Activity Area are very different to the shallower water environments at shoals/banks, reefs and islands, the likelihood that any IMS that could establish viable populations within the Activity Area could also successfully colonise these environments is low. With the stated controls in place to minimise the potential risk of translocating IMS during the activity, the likelihood of IMS being introduced to the Activity Area, becoming successfully established and subsequently spreading and establishing at a shoal, bank, reef or island is considered Remote.

9.8.2.2.3 KEFs

The Prelude FLNG facility is located ~17 km from the nearest KEF (Continental slope demersal fish communities), with the next closest KEF ~41 km from the facility (Ancient coastline at 125 m depth contour) (Figure 7-10). The demersal fish that comprise the values of the Continental slope demersal fish communities KEF comprise two distinct demersal community types, associated with the upper slope (water depth of 225–500 m) and the mid–slope (water depth of 700–1,000 m) respectively (DSEWPaC 2012). As there are no potential IMS considered to be able to credibly establish in water depths greater than 200 m (DSEWPaC 2012a), the values of this KEF are unlikely to be affected by IMS. Therefore, the likelihood of IMS being introduced and establishing viable populations that affect the values of any KEF as a result of the activity is considered Remote (Likelihood: Remote B, Consequence: Major, Residual Risk: Yellow).

The residual risk to natural values and sensitivities is ranked Yellow (see Table 9-43).

9.8.2.3 Socioeconomic Features, Values and Sensitivities

9.8.2.3.1 Fishing Industry

The establishment of IMS has the potential to impact fishing activities in the area affected through indirect effects, such as changes to the distribution and/or abundance of fisheries target species, reducing catch rates or volumes. A worst-case scenario would require an IMS to become widely established and effectively displace a habitat type or food source important for commercially fished species. However, the likelihood of IMS introduction, establishment, and spread to the extent that regional fishery stocks were impacted is Extremely Remote with the stated controls in place (Likelihood: Extremely Remote A, Consequence: Major, Residual Risk: Dark Blue).

9.8.2.3.2 Tourism and Recreation

There is no tourism or recreation activity within the Activity Area that might be affected by IMS, but nature-based activities occur at some of the shoals, banks and offshore reefs and islands in the region. Some of these activities relate to aspects of the environment potentially affected by IMS, such as diving visits to significant coral communities. As discussed in Section 9.8.2.2, the likelihood of significant impacts to these areas due to IMS being introduced to the Activity Area is considered Remote (Likelihood: Remote B, Consequence: Major, Residual Risk: Yellow).

9.8.2.3.3 Scientific Research and Restoration

Certain locations within the region(s) surrounding the Activity Area support long-term scientific research programs that could be adversely affected by the establishment of IMS. Studies concentrating on benthic communities, such as corals, could be directly impacted if habitats or species of interest were affected and indirect impacts to other research topics could result through changes to biodiversity or ecosystem function. Typically, most long-term studies are focused in relatively shallow areas such as at shoals, banks, reefs or around islands. As discussed in Section 9.8.2.2, the likelihood of significant impacts to these areas due to IMS being introduced to the Activity Area is considered Remote (Likelihood: Remote B, Consequence: Major, Residual Risk: Yellow).

9.8.2.3.4 Oil and Gas Industry

A number of operating oil and gas developments exist within the region of the Activity Area, including the Ichthys Offshore Facilities (~20 km south of the Activity Area), the Montara platform and FPSO facilities (~188 km north-east of the Activity Area) and the Crux platform (~160 km north-east of Prelude) which is interconnected to the activity via a pipeline. Potential impacts from IMS include damage to associated marine infrastructure, such as blocking water intakes or proliferating on vessel hulls or subsea structures, affecting operating efficiency and/or maintenance requirements. Generally, areas susceptible to marine fouling that may affect operating efficiency on oil and gas facilities are subject to ongoing prevention and/or maintenance programs, such as routine chemical dosing in subsea water intakes. Consequently, the likelihood of IMS that is potentially introduced into the Activity Area by the Activity subsequently spreading and colonising infrastructure that would affect the operations of any of these facilities is considered Extremely Remote (Likelihood: Extremely Remote A, Consequence: Major, Residual Risk: Dark Blue).

Overall, the residual risk to socioeconomic features, values and sensitivities is ranked Yellow (see Table 9-43).

9.8.2.4 Heritage and Cultural Features, Values and Sensitivities

9.8.2.4.1 Traditional Indonesian Fishing

Indonesian fishers are permitted to access areas within the MOU Box using traditional fishing techniques, including for target benthic species such as trepang and clams in the areas around reefs and islands. Although the Activity Area is within the MOU Box the much shallower habitats that support the target species most susceptible to IMS impacts are very different to the predominantly deeper water habitats in the Activity Area. As outlined above for shoals, banks, reefs and islands, with the controls that are proposed to be implemented to reduce the likelihood of IMS being introduced to the Activity Area, the establishment of IMS at these distinct environments due to the activity is highly unlikely and hence the risk of impacts to traditional fishing is considered Remote (Likelihood: Remote B, Consequence: Major, Residual Risk: Yellow)

Therefore, the residual risk to heritage and cultural features, values and sensitivities is ranked Yellow (see Table 9-43).

9.8.3 Risk Assessment Summary

Table 9-43 lists the highest residual risk ranking of the relevant environmental receptor groups.

Table 9-43: IMS Evaluation of Residual Risks

Environmental Receptor	Consequence	Likelihood	Residual Risk
Evaluation – Unplanned Risks			
Protected Areas	Major	B	**Yellow**
Physical Features	N/A	N/A	N/A
Physical Values and Sensitivities	N/A	N/A	N/A
Natural Features	Major	A	**Dark Blue**
Natural Values and Sensitivities	Major	B	**Yellow**
Socioeconomic Features	Major	B	**Yellow**
Socioeconomic Values and Sensitivities	Major	B	**Yellow**
Heritage and Cultural Features	Major	B	**Yellow**
Heritage and Cultural Values and Sensitivities	Major	B	**Yellow**

9.8.4 ALARP Assessment and Environmental Performance Standards

Table 9-44: Invasive Marine Species - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	No vessels	No	Vessels are essential for supply, standby safety support, and operations.	N/A	N/A	N/A
Elimination	Prohibit discharge of ballast water.	No	Vessels may be required to adjust their ballast to maintain stability, draft and trim to undertake activities. Given the low residual risk, prohibiting standard vessel ballast water discharge would provide little additional environmental benefit compared to the increase in safety risk for vessels.	N/A	N/A	N/A
Substitution	Only use local support vessels	No	Although the use of local vessels is preferred, there are cases when this is impracticable due to availability of specialised vessels for the activities.	N/A	N/A	N/A
Engineering/ Administrative and Procedural	Anti-foul coating/anti-foul system compliant with Marine Order 98	Yes	Anti-foul coating/system on the FLNG and vessels will help reduce biofouling accumulation on the hull which will reduce the likelihood of IMS introduction. Implementing this equipment control measure is required under the International Convention on the Control of Harmful Antifouling Systems on ships and the *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth), hence must be adopted.	6.1	Vessels (as appropriate for size, type and class) will have an antifoul coating applied in accordance with the International Convention on the Control of Harmful Antifouling Systems on Ships and the *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth), including Marine Order 98 (Marine Pollution – Anti-fouling Systems) including (as appropriate for size, class and type): • a valid international Anti-fouling system certificate, or • anti-fouling declaration.	A copy of a valid International anti-fouling systems certificate or a declaration on anti-fouling systems (as appropriate for class, type and size).
Engineering/ Administrative and Procedural	Vessel specific ballast management.	Yes	The likelihood of introducing IMS via ballasting activities is reduced by implementing the recommendations outlined in the Australian Ballast Water Management requirements (DAWE 2020) and aligned with the *Biosecurity Act 2015* (Cth) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (as appropriate for size, type and class). The implementation of this control is necessary to comply with legislative requirements, so it must be adopted.	6.2	Ballast water discharges are aligned with the Australian Ballast Water Management Requirements (DAWE 2020), the *Biosecurity Act 2015* (Cth) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (as appropriate for size, type and class of vessel).	Records demonstrating a Ballast Water Management Plan is in place (as appropriate for size, type and class). Records demonstrating a ballast water record system is maintained (as appropriate for size, type and class). A copy of the International Ballast Water Management Certificate to demonstrate the principle ballast water management method is in accordance with D–2 standards (as appropriate for size, type and class) If the vessel cannot demonstrate it meets D–2 standards, records of ballast water discharge logs confirm no discharge within 12 Nm of coastlines including any ports. Biosecurity Status Document (issued via Maritime Arrivals Reporting System) showing an approved ballast status (for vessels arriving from international locations and entering the Australian territory [12 nm limit] or a low-risk exemption through a domestic ballast water risk assessment (for domestic vessels and other international vessels).

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Administrative and Procedural	Vessel specific biofouling management and/or risk assessment in accordance with Section 10.8.5.1.5	Yes	Reduces the likelihood of introducing IMS by implementing proactive biofouling management options recommended under the Australian Biofouling Management Requirements (DAFF 2023) and Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2009). Implementing this system control measure is required under the legislative requirements; hence, it must be adopted. However, for vessels not entering Australian territorial seas it is seen as best practice. The implementation of this control is necessary to comply with legislative requirements, so it must be adopted.	6.3	Vessels (as appropriate for size, type and class) entering Australian territorial seas [12 nm limit] from international locations, prior to entering the Activity Area, will apply the Australian Biofouling Management Requirements (DAFF 2023), including: • an effective biofouling management plan and record book; or • vessel cleaned of all biofouling within 30 days prior to arriving in Australian waters; or • implementation of an alternative biofouling management method.	A copy of the Biosecurity Status Document (issued via Maritime Arrivals Reporting System) showing an approved biofouling status.
				6.4	Vessels (as appropriate for size, type and class) entering the Activity Area directly from international locations will implement the following requirements derived from the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2009): • conduct a biofouling risk assessment using an industry recognised IMS inspector; and • undertake IMS risk reduction measures as guided by an industry recognised IMS inspector if a vessel is not considered low risk; and; • only vessels classified as low risk will be permitted entry into the Activity Area.	IMS Inspection Report that classifies the vessel as low risk, and if required, evidence of the mitigation measures implemented to reduce the risk to low.
				6.5	Locally sourced vessels (as appropriate for size, type and class) entering the Activity Area from Australian domestic locations, will implement the following requirements derived from the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2009): • conduct a biofouling risk assessment using an industry recognised IMS inspector or using the industry recognised risk assessment tool; and • undertake IMS risk reduction measures if a vessel is not considered low risk (either guided by an IMS inspector or using the industry recognised risk assessment tool); and • only vessels classified as low risk will be permitted entry into the Activity Area.	IMS risk assessment and supporting records which demonstrate implementation actions have been carried out as required, that classifies the vessel as low risk.
Administrative and Procedural	Limit time for support vessels to be alongside the FLNG and in ports, if vessels deemed low risk.	No	The Biosecurity Reference Case (Oct 2020) states that vessels with low-risk biofouling status (such as the supply vessels and ISVs) do not require a time limit for operating alongside a facility with low-risk biofouling status (such as the FLNG); unless the biofouling status is uncertain or high. Therefore, limiting the time spent by supply vessels and ISVs alongside the FLNG is not considered an effective control.	N/A	N/A	N/A
Administrative and Procedural	Conduct routine IMS surveys on the Prelude Hull and associated sampling of potential IMS species.	No	Leading up to Prelude's arrival in Australia in June 2017 there was significant biosecurity monitoring and management activities implemented to minimise the risk of introducing any IMS into Australian territory via Prelude. Although significant monitoring and management	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			took place prior to sail-away, there was still a residual level of risk that remained at the time of sail-away. In order to follow-up, ROV hull surveys were carried out in the months following Prelude's arrival in September 2017 and again in January 2018 to inspect whether the species which could not be removed from the hull were surviving in WA-44-L. The results of these surveys found all of those IMS present before sail-away were gone with some remaining uncertainty regarding the presence of *Didemnum vexillum* (often confused with *Didemnum perlucidum* which has already been introduced in WA waters). Further monitoring in the form of eDNA water monitoring was undertaken in March 2018 and the results were inconclusive although feedback from WA DPIRD was that it was not on the list of IMS of concern due to it being widespread throughout WA. Further IMS specific ROV surveys were conducted on the Prelude FLNG hull in 2018, 2019. The surveys were reviewed by independent IMS expert and concluded no IMS of concern have been identified. The results and assessments of the subsequent ROV surveys were reviewed by NT DPIRD and WA Department of Fisheries which confirmed their alignment on the residual risk. A substantially more in depth IMS assessment of Prelude's hull was completed in 2022 utilising ROV hull integrity survey footage, which found that the biofouling coating has held up exceptionally well, that the previously observed *Didemnum* invasive species (which is already established in Australian ports) had largely died off, and that any potentially remaining *M. gigas* Pacific oysters would be unlikely to produce a self-sustaining population on Prelude or the surrounding environment. Therefore the financial and potential H&S costs of conducting regular IMS Hull surveys or physical sampling of potential IMS is considered grossly disproportionate to the benefit where the gain in terms of overall risk reduction is negligible in the context of the monitoring results since 2017 and the additional controls placed around periodic IMS reviews for supply vessels which are the main vectors for potentially spreading IMS.			
Administrative and Procedural	Conduct IMS Reviews on the Prelude Hull and associated sampling of potential IMS species, when triggered by a support vessel IMS review.	Yes	Although it is disproportionate to conduct regular IMS reviews of the Prelude Hull and eDNA sampling, it is feasible to conduct this review if triggered by the support vessels' IMS reviews identifying IMS of concern.	6.6	Conduct a 3rd party IMS review of Prelude Hull Survey if triggered by a support vessel IMS review (i.e. identified IMS of concern).	3rd party IMS review report from a Prelude Hull Survey
Administrative and Procedural	Conduct environmental DNA (eDNA) water sampling within ports visited by vessels going to and from the Activity Area	No	Due to the number of users in the port, eDNA analysis of water samples from the port will be inconclusive as to whether the risk has originated from the petroleum activities as agreed by the State marine biosecurity agencies, this is the responsibility of the State agencies.	N/A	N/A	N/A
Administrative and Procedural	Further investigation of biology, method of reproduction, propagule pressure/competency periods and behaviour, ability for adults to depart the FLNG, oceanic currents, interaction with vessels and domestic ports	No	The biology of each species needs to be considered to determine the likelihood of the species reproducing, spreading and contaminating both nearby and distant sensitive receptors and/or anthropogenic structures. This might involve investigating each species' methods of reproduction (e.g. sexual and asexual), potential larval/propagule pressure based on assessed abundance and density witnessed on the Prelude FLNG, larval/propagule competency periods and behaviour,	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			ability for adults and/or fragments to depart the vessel, strength, direction and prevailing oceanic currents, interaction with domestic conveyances, and their interaction with domestic ports of Australia. Such an assessment is complex, time-consuming and will suffer from significant knowledge gaps/uncertainty.			
Administrative and Procedural controls	In-water cleaning of the FLNG's hull	No	Limited availability of suitable cleaning methodology – Only two cleaning methodologies have been approved by the paint/coating provider for the Prelude FLNG: caviblaster and robotic/ROV cleaner provided by Samsung Heavy Industry. Other technologies have been considered and tested in Geoje (South Korea) but were determined not to be suitable as they will damage the coating, therefore, voiding the intended functionality of the coating and the warranty. The robotic/ROV cleaner can only access flat areas but will not be able to clean the niches. The caviblaster will require divers. Not all areas can be cleaned by the ROV cleaner, and divers will be required which present a significant safety exposure (diving in an offshore environment, and under a weathervaning facility). The indicative total cost would likely be more than $10 million per cleaning activity. This cost is disproportionate to the benefit gained as any in-water cleaning approach does not give certainty to the removal of all potential IMS. Cleaning will also result in disruption to operations in order for the sea-chest gratings to be cleaned as water intakes have to be shutdown which will cause disruption to normal seawater supply into the facility. Therefore, in-water cleaning may result in considerable operational disruption which will result in significant costs. As there will always be residual risk of IMS even after in-water cleaning (regardless of any cleaning technology used or even if the removed biofouling are contained) and this has been deemed as acceptable under the Shell risk assessment methodology, there is therefore limited benefit of in-water cleaning at such a disproportionate cost and safety risks. Therefore, in-water cleaning is not considered ALARP.	N/A	N/A	N/A
Administrative and Procedural controls	Develop specific IMS response plans and carry out training and drills to prepare for the need to respond to an IMS incident	No	The resources and time needed to implement this control are significant and considered grossly disproportionate to the benefit gained. The Marine Pest Response Manual (Marine Pest Sectoral Committee 2024) was revised and National Control Plans for six species have been developed as part of the National Strategic Plan for Marine Pest Biosecurity 2018–2023 (DAWE 2018) (Marine Pest Sectoral Committee 2024). Consequently, any additional benefit gained through implementing this control is considered outside the control of Shell and hence not feasible.	N/A	N/A	N/A
ALARP Demonstration Statement						
Based on the risk assessment outcomes and control measures that have been adopted, Shell considers that implementing the control measures are appropriate to manage the potential risks of introducing IMS associated with the activity. No feasible additional or alternative controls were identified that could further reduce the impacts and risks. Therefore, the impacts and risks are considered to be reduced to ALARP.						

9.8.5 Acceptability of Impacts and Risks

Table 9-45: Acceptable Levels of Risks - IMS

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Sub-category**			
Protected areas	Marine conservation reserves	No impacts to the values of marine parks.	Yes	The likelihood of impacts due to establishment of an IMS as a result of the activity is considered remote, given the application of the control measures, including adherence to relevant legislation and regulations, to reduce the likelihood of introducing IMS into the Activity Area, and that the deep offshore open waters in the Activity Area are not conducive to the settlement and establishment of IMS. The impact assessment has been based on conservative assumptions, including that conditions are conducive to IMS establishment and that the vessels mobilised are vectors for IMS. Therefore, Shell considers the residual risk associated with IMS to be reduced to ALARP and an acceptable level.
Natural features, values and sensitivities	Marine bioregions	No significant impacts to benthic habitats and communities. No significant adverse effect on demersal or pelagic communities, populations, habitats or spatial distribution of a species. No substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution. No known or potential pest species become established in the Commonwealth Marine Area.		
	Shoals and banks	No direct impacts to named banks and shoals. No loss of coral communities at named banks or shoals as a result of indirect/offsite impacts27. No known or potential pest species become established in the Commonwealth Marine Area.		
	Offshore reefs and islands	No impacts to offshore reefs and islands. No known or potential pest species become established in the Commonwealth Marine Area.		
	KEFs	No significant impacts to environmental values of KEFs		
	Fishing Industry	No negative impacts to targeted fisheries resource stocks that result in demonstrated loss of income for commercial fisheries.		

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Sub-category**			
Socioeconomic features, values and sensitivities	Tourism and Recreation	No negative impacts to nature-based tourism resources resulting in demonstrated loss of income.		
	Scientific research and restoration	No impacts resulting in abandonment of long-term established scientific research or restoration programs.		
	Oil and gas industry	Temporary displacement/interruption of petroleum exploration activities and operations within the Activity Area (excluding PSZs) is acceptable.		
Heritage and Cultural features, values and sensitivities	Traditional Indonesian fishing	No negative impacts to exploited fisheries resource stocks.		

The assessment of risks from IMS determined a highest residual risk ranking of Yellow (Table 9-43). The acceptability of the potential risks of impacts from the introduction of IMS associated with the petroleum activities has been considered in the following context:

Principles of ESD

EPOs are aligned with the principles of ESD:

- The introduction of an IMS poses a risk to the diversity and ecological integrity of the Activity Area and the wider region.

However, Shell will apply a range of controls to ensure that the risk of IMS introduction is reduced to a level that is acceptable and ALARP. Following successful application of these controls, Shell considers the residual risk to be consistent with the principles of ESD.

Relevant Requirements

Managing the risks is compliant with relevant legislation and guidelines, including:

- Compliance with international maritime conventions, including:
  - International Convention for the Control and Management of Ships' Ballast Water and Sediments
  - International Convention on the Control of Harmful Anti-Fouling Substances
    - Guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (IMO 2011)
- Compliance with Australian legislation and requirements, including:
- Biosecurity Act 2015 (Cth):
  - Chapter 4 (Managing biosecurity risk)
  - Chapter 5, Part 3 (Management of discharge of ballast water)
- Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 (Cth):
  - Part 2 (Application or use of harmful anti-fouling systems)
  - Part 3 (Anti-fouling certificates and anti-fouling declarations)
  - Marine Order 98 – Marine Pollution prevention – anti-fouling systems
- Fish Resources Management Act 1994 (WA), Fish Resources Management Regulations 1995 (WA)
- Aquatic Resources Management Act 2016 (WA)

Control measures are consistent with following guidelines and requirements:

- Reducing Marine Pest Biosecurity Risks Through Good Practice Biofouling Management Information Paper (NOPSEMA 2024)
- National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2009)
- Australian Biofouling Management Requirements (DAFF 2023)
- Australian Ballast Water Management Requirements: Version 8 (DAWE 2020)
- MarinePestPlan 2018–2023: The National Strategic Plan for Marine Pest Biosecurity (DAWE 2018)
- Offshore Installations–Biosecurity Guide: Version 1.4. (DAWE 2020a)
- WA's Biofouling Biosecurity Policy[33] (DoF 2017).

[33] This policy's objective is to minimise the adverse impacts of aquatic pests and diseases in WA through '1. Preventing the establishment of aquatic pests and diseases in new locations' and '2. Minimising the impact of established aquatic pests and diseases'. As such, the acceptable level of risk for IMS (stated in the EPO) is consistent with this policy.

Strict controls are in place to prevent the introduction of IMS into Australian waters, which the project will abide by. Biosecurity is regulated under the *Biosecurity Act 2015* (Cth). The Australian Ballast Water Management Requirements (DAWE 2020) provides Australia's commitment to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Convention). The National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2009) gives recommendations to the petroleum industry for managing biofouling hazards. The control measures adopted in Table 9-44 are aligned with these guidelines, which vessel operators must abide by.

Matters of National Environmental Significance

Threatened and Migratory Species

The policies, strategies, guidelines, conservation advice and recovery plans for MNES that may occur within the potential area affected by an IMS do not identify IMS as a threat.

Commonwealth Marine Environment

With the controls that will be implemented, the activity is not likely to result in the introduction of IMS that causes impacts that exceed any of the significant impact criteria for the Commonwealth Marine Area listed in Table 9-46; as such, it is considered that the aspect is not likely to result in significant impact to the Commonwealth marine environment.

Table 9-46: Summary of Alignment of the Risks from the IMS Aspect of the Prelude Petroleum Activities with Relevant Requirements for EPBC Threatened Fauna

MNES	MNES Acceptability Considerations	Demonstration of Alignment
Threatened and Migratory Species	The threatened and migratory species within the Activity Area are all highly mobile. Benthic species are generally more susceptible to the effects of IMS and there are no EPBC Act listed benthic species in the Activity Area.	N/A
Commonwealth Marine Area	Significant impact guidelines for the Commonwealth marine environment (Table 8-1)	The risk assessment indicates that this aspect of the activity is not likely to result in any impacts that exceed the Commonwealth marine environment significant impact criteria, as listed in Table 8-1; as such, it is considered that the aspect does not pose an unacceptable risk to the Commonwealth marine environment.

External Context

DPIRD made a claim relating to best practice biofouling management, to advocate for biofouling to be kept to a minimum to mitigate the risk of harbouring marine pest and disease, including reporting suspected or confirmed presence of any marine pest or disease within 24 hours. Shell confirmed that the Shell Marine Vessel Assurance Program requires all marine vessels planned to be used in the activity area achieve positive vetting through a marine vessel biofouling risk assessment. Reporting requirements are included in the EP.

Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4.

Internal Context

Shell also considered the internal context, including Shell's environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented, are consistent with the outcomes from consultation for the petroleum activity and Shell's internal requirements.

Acceptability Summary

The assessment of risks from IMS determined the highest residual risk rankings were Yellow (Table 9-43). The acceptability of the impacts and risks from IMS associated with the activity has been considered in the context of:

- the established acceptability criteria
- ESD
- relevant requirements
- MNES
- external context (i.e. relevant persons claims or objections)
- internal context (i.e. Shell requirements).

Given the considerable water depth (>235 m), potential IMS species which may be present on the Prelude FLNG, equipment and/or vessels used for the activity would be unlikely to settle and establish on the available natural substrate within the Activity Area or the nearest shallow water sensitive receptor, Browse Island, which is located approximately 25 km away from the Activity Area. Considering all of the controls which are in place, the residual risk of potential species of IMS being introduced to the Activity Area, persisting on the Prelude FLNG, spreading, attaching to vessel hulls and establishing in new areas such as high value areas and/or inshore coastal waters of Australia such as at ports following a long distance vessel transit is Yellow or less.

Shell considers residual risks of Yellow to be acceptable with controls if they meet legislative and Shell requirements. The discussion above demonstrates that these requirements have been met in relation to the IMS aspect of the petroleum activities.

Shell considers the risks from IMS introduction associated with the petroleum activities to be ALARP and acceptable.

9.8.6 Environmental Performance Outcomes

EPO #	EPO	Measurement Criteria
6.1	No IMS of concern[34] introduced in the Activity Area as a result of the activities.	No confirmed and externally reported instances of IMS within the Activity Area as a result of the activities.

[34] IMS of concern are species that are listed on the WA Prevention List for Introduced Marine Pests or Commonwealth National Introduced Marine Pest Information System and could survive in the natural environment beyond the facility infrastructure.

9.9 Produced Water Discharge

9.9.1 Aspect Context

Produced water (PW) is water which has permeated into the gas reservoir over time, and which may comprise condensed water (water vapour present with gas/condensate that condenses when brought to the surface) and saline formation water. Prelude PW is separated from the hydrocarbons extracted from the reservoir products in the inlet facilities, following comingling of Crux hydrocarbons, and following treatment to ensure it meets required standards, is discharged into the marine environment. The PW discharge is located near the bow of the FLNG facility, approximately 31 m aft of the turret, and on the starboard side at approximately 5 m below the water line.

PW contains a variable range of inherent and added contaminants, such as salts, hydrocarbons, metals, phenols, nutrients (e.g. ammonium) and residual production chemicals. The Prelude PW is subject to tertiary treatment prior to discharge via a Macro Porous Polymer Extraction (MPPE) Package (Section 6.9.6) and is monitored and managed in accordance with the PW Adaptive Monitoring and Management Framework (AMMF) (Section 10.8.1) to ensure potential impacts are continuously minimised to ALARP. The PW treatment system, including the MPPE Package, is designed to ensure that the design maximum PW discharge rates from the FLNG facility (i.e. 172 m^3/hr or 4,128 m^3/d) would contain less than 30 mg/L Total Petroleum Hydrocarbons (TPH) daily average during normal operating conditions. The TPH content of the discharge is monitored and a buffer tank is available to capture and recycle PW through the treatment system if it is off-specification.

The Prelude AMMF requires (Table 9-47) topsides monitoring, chemical characterisation and direct toxicity assessments (DTA) of the PW to be undertaken with the results linked to management responses where necessary to ensure the discharge will continue to meet relevant standards over the life of operations. The DTA (also known as whole-of-effluent toxicity (WET) testing) identifies the ecotoxicity of the entire PW discharge, including potential synergistic and additive effects of all combined PW constituents, using the currently accepted methodology for the derivation of water quality criteria in Australia and New Zealand (ANZG 2018).

It is anticipated that the composition of the PW discharge will vary over time as the reservoir and production characteristics change with variations in reservoir gas permeability. PW generation from gas fields commonly increases over time as gas is depleted from the reservoir. This may cause the PW flow rates and composition to change, which in turn may cause intermittent fluctuations in PW volumes/quality to the treatment facility and thereby affect the discharged effluent constituent concentrations. Production from the Prelude field is in a relatively early phase and consequently the volume of PW discharged has been low and has largely occurred in batches consisting of condensed water (freshwater condensed out of the gas phase through the process). Based on the measured PW flow rates during 2021 to 2025 (Section 9.9.2.1) and the results of discharge characterisation (Sections 9.9.2.2 and 9.9.2.3) and dispersion modelling (Section 9.9.2.4), all constituents would be expected to have been diluted to below relevant DGVs within the defined mixing zone and the associated EPOs/EPSs (Shell 2021) achieved.

It is anticipated that for the duration of this EP, condensed water will continue to comprise most if not all of the PW and will be discharged in batches at rates typically below 100 m^3/hr to ensure that the integrity of the MPPE beds is maximised. The estimated (P50) volume of Prelude PW (condensed and formation water) is forecast to average ~ 467 m^3/day over 2026 and increase to average ~ 486 m^3/day over the next three years (to 2029). Prelude late-field life PW volumes are forecast to peak at ~529 m^3/day, comprising ~132 m^3/day formation water and ~397 m^3/day condensed water.

Adaptive monitoring and management of the PW, including ongoing topsides monitoring, chemical characterisation and DTA, will continue to be applied (Section 10.8.1) to ensure potential risks from known and any unknown toxic components in the discharge are identified and appropriately managed to ALARP and acceptable levels.

9.9.2 PW Monitoring, Modelling and Investigations

Monitoring and management of the Prelude PW discharge over the period 2021–2025 (i.e. since the last revision of this EP was accepted by NOPSEMA) was undertaken in accordance with the AMMF described in Section 10.4 of the accepted EP (Shell 2021). The requirements of this adaptive management framework are

summarised in Table 9-47, with further detail of the monitoring/management conducted, including a summary of outcomes, provided in Sections 9.9.2.1 to 9.9.2.4.

Table 9-47: 2020 AMMF Requirements for PW

Monitoring Component	Summary
Topsides monitoring	Ongoing monitoring of flow rates and TPH content in the discharge. Additional monitoring as a result of trigger exceedances
PW Chemical Characterisation	Annual sampling and laboratory analyses of PW chemical constituents Additional testing as a result of trigger exceedances or significant change
WET testing	6 monthly testing for 18 months starting no later than Q2 2021, then triennially thereafter. Testing on a full suite of species (minimum of five) for the initial two sampling occasions, then suite reduced to a minimum of two species for succeeding samples in first 18 months of the sampling regime. Full suite of species (minimum of five) conducted for each triennial sampling event. Additional WET testing as a result of trigger exceedances or significant change Mixed Discharges WET test: once off, after initial field water sampling survey and coinciding with scheduled PW WET testing
Field water quality sampling	5-yearly Additional field sampling as a result of trigger exceedances
PW Model verification	One planned model verification event within the 5-year validity period of this EP. Additional model verification as a result of a trigger exceedances
PW sediment quality sampling	Initially by 2030 or sooner

9.9.2.1 Topsides Monitoring

Measurements of flow and oil in water (TPH) in the PW discharge during 2021-2025, recorded by means of inline meters and onboard analyses, are summarised in Table 9-48. Flow readings were undertaken continuously during discharge periods and OIW measured at six-hourly intervals when discharge occurred. Discharge has been intermittent and at low (<50-75 m^3/hr monthly average) rates throughout, particularly during early stages of operations. TPH levels in the discharge were consistently low, with average concentrations typically <2 mg/L.

9.9.2.2 Chemical Characterisation

Monitoring of the chemical composition of the PW discharge included both dedicated chemical characterisation sampling as well as chemical analyses on samples collected for DTA. In response to the interruptions to early operations and the desire to confirm representative PW composition, sampling and analyses of physiochemical parameters of the PW discharge were initially undertaken more frequently than required by the AMMF. As a result, a total of six sampling/analyses events were conducted in 2021, seven in 2022, two in 2023 and one in both 2024 and 2025.

Dedicated samples were collected of PW downstream of the MPPE on the FLNG facility and sent directly to a NATA accredited laboratory for analyses. Samples of PW collected for DTA were sampled at the same location on the FLNG facility and distributed to four DTA testing facilities, with subsamples subsequently sent from each testing facility to a NATA accredited analytical laboratory for chemical characterisation.

Table 9-49 summarises the key physicochemical characteristics of the PW discharge over these years, including all the constituents detected above limit of reporting (LOR) in at least one sample for which there are reliable DGVs (ANZG 2018). Physico-chemical analyses of this PW showed it to be low-salinity (170–260 mg/L) and moderately acidic (pH 5.1–6). Total hydrocarbon (TRH) levels were low (<1.4 mg/L) and PAHs not detected above laboratory LOR. Benzene was typically the highest concentration aromatic (up to ~25 ppb), but orders of magnitude below the 99% species protection DGV of 500 ppb (ANZG 2018). Naturally occurring

radioactive materials (NORMs) were below LOR or international impact thresholds, even in the absence of dilution. The dissolved concentrations of only 7 metals were consistently above LOR, namely boron, iron, barium, aluminium, zinc, manganese and nickel. The highest number of dilutions required for any of these metals to achieve relevant DGV's is ~10 for aluminium (Table 9-50). Mercury levels have remained below LOR and/or 99% species protection DGV in all samples.

Based on the measured PW flow rates during the periods of sampling (Section 9.9.2.1) and the results of discharge dispersion modelling (Section 9.9.2.4), all constituents would be expected to have been diluted to below relevant DGVs within the defined mixing zone and the associated EPOs/EPSs (Shell 2021) achieved.

The PW samples in 2022 and 2023 were found to have elevated levels of amines and glycols (Table 9-54), and the 2024-2025 PW, sampled after modifications to reduce the potential for partitioning of process chemicals, is therefore considered to be most representative of the PW that will be discharged during early phases of stable production operations, including over the duration of this EP. The dispersion modelling confirms all the constituents of this PW would be expected to achieve PC99% levels within a short distance of the discharge port (Table 9-50) at both expected and maximum discharge rates. Sampling and chemical analysis of the discharge, applying the same methodologies outlined above, will continue during the activities covered by this EP in accordance with the AMMF described in Section 10.8.1.

Table 9-48: Topside Monitoring of PW Discharge 2021–2025

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total/Av.
2021													
Monthly flow overboard m^3	6,170	2,351	7,997	7,229	3,188	7,992	7,630	8,517	7,004	5,312	9,031	-	**72,421**
Monthly Av. m^3/h	37	58	50	50	54	56	54	55	21	46	51	-	**48**
Average OIW mg/L	1.9	1.8	1.5	1.5	8.3	1.5	1.5	1.5	1.5	1.5	1.5	-	**2.2**
2022													
Monthly flow overboard m^3	-	-	1,002	10,695	8,264	8,517	2,532	1,122	9,132	7,036	965	5,656	**54,921**
Monthly Av. m^3/h	-	-	55	51	52	53	46	46	46	49	40	47	**48**
Average OIW mg/L	-	-	1.5	1.9	2.9	1.5	1.5	2.5	1.5	1.5	1.5	1.5	**1.8**
2023													
Monthly flow overboard m^3	5,062	4,722	8,873	9,385	8,758	8,914	6,803	5,999	-	-	-	9,772	**68,228**
Monthly Av. m^3/h	50	47	49	50	51	50	41	43	-	-	-	39	**47**
Average OIW mg/L	1.5	1.5	1.6	1.6	1.6	1.6	1.7	2.9	-	-	-	4.6	**2.1**
2024													
Monthly flow overboard m^3	13,182	17,719	15,465	10,739	15,451	18,589	15,073	21,654	14,985	19,103	22,817	19,904	**204,683**
Monthly Av. m^3/h	36	41	42	72	92	92	89	87	75	88	80	91	**74**
Average OIW mg/L	1.8	1.6	1.6	2.0	1.7	1.8	3.1	1.7	3.9	1.8	2.0	3.1	**2.2**
2025													

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total/Av.
Monthly flow overboard m^3	11,775	10,266	20,249	20,522	14,459	16,721	19,383	16,729	9,765	-	-	-	-
Monthly Av. m^3/h	76	68	72	64	102	91	85	86	97	-	-	-	-
Average OIW mg/L	2.8	8.5	3.4	2.0	1.6	2.2	1.7	1.7	1.7	-	-	-	-

Table 9-49: Average PW Key Constituent Concentrations 2021–2025[35]

Parameter	Units	LoR	PC99% DGV	2021	2022	2023	2024	2025
pH	pH Units	-	-	6.2	5.70	6.00	5.1	5.6
Salinity	mg/L	2	-	239	188	245	200	250
Total Dissolved Solids	mg/L	10	-	73	78	86	170	-
Total Suspended Solids	mg/L	5	-	<5	<5	<5	<5	<5
Ammonia, as N	µg/L	10	500	**3874**	**4860**	**6400**	**4800**	**6500**
Aluminium	µg/L	5	9	<5	6.1	5.5	**57.5**	**94**
Arsenic	µg/L	0.5/1	-	<1	<1	<1	<0.5	<0.5
Cadmium	µg/L	0.05/0.1/1	0.7	<1	<1	<0.1	<0.05	<0.05
Chromium	µg/L	0.5/1	0.14	<1	<1	<1	<0.5	<0.5
Cobalt	µg/L	0.5/1	0.005					<0.5
Copper	µg/L	0.5/1	0.3	<1	<1	<1	<0.5	<0.5
Lead	µg/L	0.5/1	2.2	<1	1.6	<1	<0.5	<0.5
Nickel	µg/L	1	7	3	3.1	1.2	2.3	1
Zinc	µg/L	5	3.3	<5	**13.8**	**15.2**	**20.8**	**17**
Mercury	µg/L	0.05	0.1	<0.05	<0.05	<0.05	<0.05	<0.05
Benzene	µg/L	0.5	500	0.5	6	16.6	11.1	25
Toluene	µg/L	0.5/1	110	0.5	<0.5	4.4	0.9	<1
Ethylbenzene	µg/L	0.5/1	-	<0.5	<0.5	<0.5	<0.5	<1
Xylenes	µg/L	0.5/1	-	<0.5	<0.5	<0.5	<0.5	<1
Total BTEX	µg/L	2	-	<2	6	21	12	25
Phenol	µg/L	0.01	270	**3856**	**1816**	**1240**	**1975**	**3200**
Naphthalene	µg/L	0.1	50	<1	<0.1	<0.1	<0.1	<1

[35] Average value for samples in each year. Bolded entries are analytes detected (>LOR) at concentrations above ANZG (2018) 99% species protection DGV for marine waters

Table 9-50: PW Key Constituent Concentrations and Dilutions Required to Achieve PC99% levels (based on highest recorded concentration between 2021 and 2025).

Parameter	Units	Reporting Limit	PC99%	Highest Recorded Concentration (2021-2025)	Dilutions Required to Achieve PC99%
Ammonia, as N	µg/L	10	500	6500	13
Aluminium	µg/L	5	9	94	10.4
Cadmium	µg/L	0.05/0.1/1	0.7	<0.05	0
Chromium	µg/L	0.5/1	0.14	<0.5	0
Cobalt	µg/L	0.5/1	0.005	<0.5	<100
Copper	µg/L	0.5/1	0.3	<0.5	<1.7
Nickel	µg/L	1	7	3.1	0
Zinc	µg/L	5	3.3	20.8	6.3
Mercury	µg/L	0.05	0.1	0.06	0
Benzene	µg/L	0.5	500	25	0
Methyldiethanolamine	mg/L	0.01	0.017	1.1	64.7
Piperazine	mg/L	0.01	0.014	0.3925	28.0
MEG	mg/L	2	6.1	79.75	13.1
Pentachlorophenol	µg/L	0.1	11	<0.1	0
Phenol	µg/L	0.01	270	3856	14.3
Naphthalene	µg/L	0.1	50	<0.1	0

9.9.2.2.1 Mercury

Mercury is a highly volatile element that has a strong affinity for organic matter. It is soluble in natural gas and condensates and present in hydrocarbon basins globally, exhibiting a wide range of concentrations. The physical, chemical and geochemical properties of mercury create complex distributions in hydrocarbon systems. Through the process of thermal evolution, mercury concentration in hydrocarbons can be influenced by source rock origin, migration pathway and fluid chemistry (Lawer et al 2023).

To date mercury levels in the PW have been below the detection limit of 0.05 µg/L, with the exception of one sample which recorded 0.06 µg/L (ANZG guideline value for 99% species protection in marine waters is 0.1 µg/L, 80% level of species protection is 1.4 µg/L). A mercury partitioning study undertaken looked at the expected mercury concentrations in the PW discharge for both Prelude only and Prelude plus Crux cases (Table 9-51). The study predicted mercury concentrations in the Prelude only case to be <2 µg/L, indicating that the solubility of elemental mercury in water is likely over-predicted by the model. The mercury present is expected to be predominantly elemental based on Shell partition modelling, which have low bioavailability. At these rates, assuming constant composition, the predicted discharge loading of mercury into the marine environment commingled with the produced water discharge would be ~0.4 kg/year for the Prelude only case.

Table 9-51 Mercury partitioning study showing expected mercury concentrations in the PW discharge for both Prelude only and Prelude plus Crux.

Process Area	Description	Case	Total Mass Flow, kg/h	Hg Conc. (ug/L)	Hg Partitioning (mass% of inlet Hg)	Hg Yearly Rate (kg/yr)
Produced Water	Produced Water	1 Prelude Only	21637	1.9	0.04%	0.4

Process Area	Description	Case	Total Mass Flow, kg/h	Hg Conc. (ug/L)	Hg Partitioning (mass% of inlet Hg)	Hg Yearly Rate (kg/yr)
		2 Crux Day 1	22695	3.6	0.04%	0.7
		3 Crux Only	9	3.6	0.00%	0.0
		4 Prelude/Crux EOP	24049	4.3	0.05%	0.9
		2.1 Cold with MEG	23036	6.3	0.08%	1.3
		1.2 V-10007 WFG	21634	1.9	0.04%	0.4

Post addition of Crux gas, the mercury content in the PW is predicted to increase to 4.3 µg/L. Crux fluids do not contain a free aqueous phase, however, Crux condensate and Prelude liquids (inclusive of condensate and produced water) are co-mingled in LP Separator V-10012. The model assumes perfect mixing and that a perfect equilibrium between condensate, water, and mercury is achieved in V-10012, and therefore that the mercury arriving in the Crux condensate partitions into the Prelude PW in V-10012. This perfect mixing is unlikely and the model likely over predicts mercury solubility in water. Therefore, actual mercury content in PW is expected to be lower.

An additional case which assumes a cold Crux arrival temperature due to pipeline packing and MEG injection was also assessed, with an increase of mercury in water to 6.3 µg/L (a 75% increase). This is assumed to be partly due to the increased mercury concentration of the Crux condensate phase in V-10012, and partly due to the increased solubility of mercury in the aqueous phase in the presence of MEG. This is, however, also likely to be over-predicted and is expected to be lower. Based on a worst-case mercury concentration of 6.3 µg/L (Case 2.1 in Table 9-51) a predicted discharge loading of mercury into the marine environment commingled with the produced water discharge would be ~1.3 kg/year.

9.9.2.3 Direct Toxicity Assessment

To determine the holistic toxicity of the Prelude PW discharge, whole-of-effluent DTA was undertaken and used to derive PW toxicity metrics (i.e. PC99% and PC95% SPL) consistent with the currently recommended methodology for the derivation of water quality criteria in Australia and New Zealand (ANZG 2018). These could then be applied in conjunction with the PW dispersion modelling results to determine the likely distances from the PW discharge location over which potential impacts may occur, confirm compliance with the predicted mixing zone described in the accepted EP (Shell 2021) and/or trigger further monitoring or management in accordance with the AMMF.

Samples of PW were collected downstream of the MPPE on the FLNG facility and distributed to four DTA testing facilities — AIMS (Townsville), AIMS (Darwin), Ecotox Services Australia (Sydney) and Intertek (Perth) — for toxicity tests on 11 tropical marine species. The tests undertaken are summarised in Table 9-52.

Table 9-52: Toxicity Tests Undertaken on PW

Test species	Generic name	Taxonomic group	Assay
Amphibalanus amphitrite	Striped acorn barnacle	Arthropoda (cirriped)	4-d larval development
Exaiptasia pallida	Glass anemone	Cnidaria	14-d asexual reproduction
Nassarius dorsatus	Channelled dog whelk	Mollusca (gastropod)	7-d larval growth
Tetraselmis sp.	Green microalga	Chlorophyta	3-d population growth
Tisochrysis lutea	Golden-brown microalga	Haptophyta	3-d population growth

Cladocopium proliferum	Dinoflagellate microalga	Myzozoa	7-d population growth
Rhodomonas salina	Red microalga	Cryptophyta	3-d population growth
Nitzschia closterium	Diatom microalga	Heterokontophyta	3-d population growth
Parvocalanus crassirostris	Calanoid copepod	Arthropoda (copepod)	4-d larval development
Saccostrea scyphophilla	Milky oyster	Mollusca (bivalve)	2-d larval development
Echinometra mathaei	Burrowing sea urchin	Echinodermata	3-d larval development

Based on biological effects observed in the PW treatment solutions, no-significant-effect concentrations (N(S)EC) and 50% effect concentrations (EC50) were estimated from model-averaged posterior predictions using the bayesnec package version 2.1.3.0 in R version 4.4.1. Species sensitivity distribution (SSD) were then modelled from the cumulative distributions of N(S)ECs (chronic) or EC50s (acute) using the ssdtools package version 2.3.0 (Thorley et al. 2025). From the fitted SSDs, concentration values for 99% and 95% species protection (PC99% and PC95%) were derived.

The AMMF required DTA (WET testing) of the PW discharge to commence in 2021 and include three rounds over the subsequent 18 months of discharge before becoming triennial. However, due to logistical constraints, the 2021 samples were collected on two separate days and chemical analyses indicated pronounced differences in the PW chemistry between days, affecting the toxicity response of test organisms and confounding the derivation of SSD-derived toxicity metrics (PC99%, etc.). Consequently, the results were reported to not be suitable for the purposes of the AMMF and a further 3 rounds of testing recommended (AIMS 2025).

The 3 rounds of DTA were subsequently undertaken in 2022, 2023 and 2024. A summary of these tests, including the resulting toxicity values and associated PW dilution requirements to achieve protection of 99% of species are presented in Table 9-53.

Table 9-53: PW Discharge DTA Summary

PW Sampling Date	No Species Tested	PC99% (% PW)	No. Dilutions Required
11/10/2022	11	0.0081	12346
20/02/2023	11	0.016	6250
17/07/2024	11	0.034	2941

As can be seen from Table 9-53, the DTA showed considerable variation in the toxicity of the different PW samples with both the 2022 (in particular) and 2023 PW substantively more toxic than the 2024 sample. Review of the chemistry of these samples indicated that this was unlikely to be due to TPH or dissolved metals in the PW as these remained low (Section 9.9.2.2), but may be related to unexpectedly high levels of amines and glycols in the 2022 and/or 2023 PW samples, likely associated with the process chemicals Adapt (amine) and/or MEG respectively, which were orders of magnitude higher than in the 2024 sample (Table 9-54).

Table 9-54: Amine and Glycol Concentrations in PW Discharge

PW Sampling Date	Aliphatic Amines (mg/L)		Glycols (mg/L)
	Piperazine	Methyldiethanolamine	Ethylene Glycol
11/10/2022	34	310	3048
20/02/2023	92	240	<2
17/07/2024	0.39	0.66	79.8

At the time of the PW sampling in 2022 and 2023, PW discharge rates were significantly below the design discharge rates and hence subject to rapid dispersion following discharge to sea. Based on the results of the field validation study and refined dispersion modelling (Section 9.9.2.4), it is likely that the resulting plume would have become sufficiently diluted to achieve 99% species protection within the defined (1 km) mixing zone. Nevertheless, consistent with the AMMF, further investigations and modifications to the PW system were undertaken to identify and evaluate potential contributors to the elevated toxicity of the PW stream identified by the DTA, and to assist in ongoing reduction of potential impacts, including:

- Assessing (via DTA) whether comingling of PW with (chlorinated) cooling water following discharge would increase plume toxicity.
- Deriving (via DTA) moderate to high-reliability 99% species protection guideline values for amines and glycols that are used in the Prelude production system and can potentially be present in the PW stream, specifically methyldiethanolamine (amine), piperazine and MEG.
- Implementing measures to prevent amine and piperazine entering the PW during normal operations.
- Monitoring and limiting MEG concentrations in the PW discharge.
- Development of a mechanistic toxicity model to predict likely chemical contributors to PW toxicity and potential additive effects.

These additional initiatives have confirmed that comingling with cooling water does not alter the PC99% for the PW plume, but that elevated concentrations of process chemicals can be expected to increase PW discharge toxicity and, therefore, the 2024 PW sample can be considered the most representative for the PW discharge over the period of this EP. The AMMF for PW (Section 10.8.1) has been updated to incorporate the results of studies undertaken to date.

9.9.2.4 Overview of PW Discharge Modelling

Hydrodynamic three-dimensional numerical dispersion modelling for the PW discharge was initially undertaken in 2012, prior to the completion of construction of the FLNG facility and using (then) design specifications, with subsequent studies in 2019 to 2020. Notably, the 2012 modelling was based on a single (maximum design) PW discharge rate of 165 m^3/hr (3,960 m^3/d) and an anticipated PW composition.

In accordance with the AMMF, field validation of the modelled dispersion was undertaken within the five-year currency period of the previous revision of this EP (RPS 2025a). The field validation study included in-situ sampling of seawater within the PW plume and measurements of both dye (rhodamine) and PW constituents at varying distances from the PW discharge outlet to provide a comparison of actual dilution rates with those predicted by the dispersion modelling. Key outcomes of the study were:

- Field-measured dilution distances for the dye tracer were broadly comparable but considerably shorter than those predicted in the EP (Shell 2021) based on dispersion modelling results. For example, the mixing zones for 1,000 and 5,000 dilutions were calculated at ~63% and 45% respectively of those described in the EP. The distances calculated from the dye tracing study are likely to be conservative because current speeds were relatively high (forcing fast movement of the plume) and the sea-state was low (forcing relatively low mixing). The PW discharge rates at the time of the study were lower (i.e. ~60-106 m^3/hr) than those assumed in the modelling, but higher than average discharge rates recorded over most of 2021-2025 (Table 9-48).
- PW constituents measured in the discharge plume indicate a significantly higher reduction in concentrations following discharge than predicted by the dispersion modelling, with no impacts on seawater pH, salinity or conductivity and no exceedances of 99% marine species protection DGVs due to PW contaminants at any location. Dilutions of phenol, the only chemical detected in seawater samples that could be reliably attributed to PW, ranged from 380 to 13,571-fold immediately following discharge (vs the ~12-fold dilution typically required to achieve the 99% SPL [Table 9-50]).
- Adjustment of the horizontal dispersion rate (1 m^2/s) previously applied in dispersion modelling to a more conservative rate of 0.2–0.25 m^2/s would improve the accuracy of the modelling. However, overall, the results showed little to no risk of impact from PW discharge on the marine waters outside the EP defined mixing zones (AIMS 2025).

The outcomes of the dispersion validation (RPS 2025a), along with refinements in hydrodynamic modelling techniques since the previous modelling, and the use of as-built (e.g. discharge port configuration) and/or measured parameters (e.g. PW composition, water currents at the FLNG location) relevant to discharge dispersion (rather than design/representative specifications) were applied to develop a more accurate dispersion model.

This model was then used to provide an improved prediction of actual PW discharge behaviour, with consideration of different flow rates, representative of different stages of production and informed by operational experience of the FLNG facility.

The updated dispersion study (RPS 2025c) considered processes occurring at two different scales: “near-field” processes generated by the discharge and “far-field” processes generated by the ambient current field and ocean turbulence. The near-field mixing zone refers to the region where the plume’s momentum or buoyancy (or both) are the strongest influence on the dilution process. The far-field modelling assessed the dispersal of the PW plume beyond the near-field accounting for the time-varying nature of local currents and assessed the potential for recirculation of the plume back to the discharge location, in which case the near-field concentrations might be increased beyond those indicated in the near-field modelling.

Two scenarios were modelled: a PW discharge of low salinity water at 95 m^3/hr for 4 days in a week, representative of early phases of operations (including the duration of this EP), and a discharge rate of 155 m^3/hr for 2.5 days in a week, to address a potential increase in PW production during later phases of operations. Each discharge scenario would involve discharge for ~45 minutes to empty a storage tank, with ~15 minutes between discharges for recharge. A MEG concentration of up to 1% in the PW was assumed to ensure associated density effects on buoyancy were incorporated.

Far-field dispersion was calculated for each scenario using the dispersion model CHEMMAP, assuming that the constituents were not reactive or subject to degradation, only dispersed due to current flow and turbulence in the water column. A stochastic modelling procedure was applied to account for variation in the current speed and direction that could occur during the discharge. This involved simulating 300 discharge periods for each scenario, with varying current speed and direction selected at random from the range of current measurements recorded at the Prelude metocean-buoy (CMAO4) from 1st February 2024 to 25th June 2025.

To account for the movement of the FLNG facility during periods of discharge, which would add to the initial spread of the PW, heading data that was available for corresponding time-steps was also applied to calculate the changing position of the discharge port relative to the centre of the turret, which is the only location on the vessel that has a fixed location relative to the earth. The influence of this approach would vary with the rate of swing of the vessel at varying times.

Dispersion during each simulation was calculated with distance applying fixed spreading rates in the horizontal and vertical. Horizontal dispersion was applied at 0.25 m^2/s and vertical dispersion was applied at 3 cm^2/s. These rates were derived by sensitivity testing during the field validation study, which involved calculating dilution with distance of a dye tracer released with the PW. This sampling was carried out under relatively calm sea conditions (<0.7 m waves) and low wind speeds (<5 m/s) which are likely to have resulted in low rates of dispersion. Consequently, the dispersion allowances in the modelling are considered conservative for the wider range of sea conditions affecting the location, which are frequently more energetic. It should also be noted that dispersion rates will tend to increase with increasing distance. Consequently, the settings would be even more conservative at the outer distances that were calculated for adequate dilution.

The modelling outcomes from all simulations for each scenario were statistically analysed to determine the lowest 5th percentile of dilutions (higher concentrations) that were ever predicted for each cell among the replicate simulations. The mean dilution with distance was then calculated by pooling all 5th percentile dilutions calculated at the defined distances and averaging the values. The minimum dilution with distance was calculated by finding the lowest of the 5th percentile dilutions ever calculated at the defined distance. For conservatism, the lowest dilution calculated at any depth level over time during each simulation was targeted for this analysis. Because the plume was initially buoyant and would mix down over time, calculations for the surface layer would be selected by this approach. The 5th percentile dilution was deemed to be most appropriate to represent extreme (i.e. ‘worst-case’) outcomes due to the layers of conservatism in the model configuration.

Modelling of a discharge rate of 95 m^3/hr of low salinity PW, reflective of the average expected rate of condensed water discharge that may occur during the period of operations covered by this EP, indicates that the initial discharge velocity (0.69 m/s) approximates the 95th percentile current speed flowing past the discharge and is only ~twice the speed of the median current, hence there would be rapid deflection of the plume down-current, and the discharge jet would extend only a small distance from the hull (<1 m) before rising to the water surface due to buoyancy. At the boundary of the defined mixing zone (i.e. 1 km), the average and lowest dilutions achieved for the lowest 5th percentile of dilutions (Table 9-55) would be ~11,800-fold and 5,300-fold respectively.

For the higher discharge rate, the initial discharge velocity would be higher (1.13 m/s) causing the discharge jet to extend further (~1.5-2 m), and the plume would therefore take longer to rise to the surface with additional initial dilution. However, the greater volumes of discharge would result in lower far-field dispersion rates which would fall to ~1:8,200 mean dilution and ~1:4,100 lowest dilution (of the lowest 5th percentile of dilutions) at the boundary of the defined mixing zone (RPS 2025c).

Table 9-55: Predicted PW Discharge Dispersion

Distance (m)	95 m^3/hr Discharge Dilution (5th Percentile)	
	Mean Dilution	Lowest Dilution
20	1,046	17
50	2,086	163
100	2,224	245
200	2,986	1,001
300	3,887	1,632
400	4,775	2,187
500	5,753	2,633
600	6,895	3,024
700	7,814	3,540
800	9,233	4,082
900	10,629	4,758
1000	11,784	5,254
1100	12,619	5,550
1200	14,022	6,035
1300	15,021	6,620
1400	16,312	6,999
1500	18,135	7,390
1600	19,662	7,761
1700	21,621	8,256
1800	23,631	9,086
1900	26,467	9,790
2000	30,265	10,791
2500	123,654	15,270
3000	185,267	24,938

At these dilution rates, and considering the expected toxicity of the representative PW composition based on DTA (Section 9.9.2.3), sufficient dispersion to assure protection of 99% of species would be expected to be achieved for Prelude PW within the mixing zone for the duration of operations.

9.9.3 Description and Evaluation of Impacts

Table 9-56 indicates the environmental features and values and sensitivities that have been identified to be potentially affected by the PW discharge that may occur during the activities covered by this EP, with further evaluation of the impacts and/or risks to each potentially affected receptor category (including cumulative impacts) provided in Sections 9.9.3.1 to 9.9.3.5. Features or values and sensitivities which could not be credibly affected by PW discharges are not discussed further.

Table 9-56: PW Discharge Receptor Impact Screening Summary

	Protected Areas			Features																	Values and Sensitivities																				
				Physical		Natural				Socioeconomic								Heritage and Cultural			Physical				Natural							Socioeconomic							Heritage and Cultural		
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect									×													×	×								×										

Legend:		
		Potentially affected
	×	Predicted impact

9.9.3.1 Natural Features

9.9.3.1.1 Timor Province Bioregion

Benthic Communities

Given the water depth that Prelude is moored in (>230 m), and the results of analyses conducted on the FLNG discharge streams (Section 9.9.2), there will be no direct interaction of the PW plume with the benthic environment. The only potential impact pathway is therefore via inherent solids, precipitates or adsorbed particles settling onto the seabed over time.

Due to the effective dispersion of the PW that occurs following discharge (Section 9.9.2.4), the small sizes and low levels of solids in the discharge and low concentrations of constituents that may form particulates in the PW (Table 9-49), the time for particulates to settle the >200 m to the seabed will be such that any settlement will likely occur over a widespread area of seabed (10s-100s of km). Finer fractions may never settle out of the water column (Woodside 2025) and/or be subject to resuspension and further dispersion over time. Consequently, the potential for contaminants in the PW stream to cause detectable changes in sediment quality is expected to be limited (see Section 9.9.3.2.2) and require discharge for a considerable amount of time (10s of years). Chemical characterisation (Section 9.9.2.2) shows that the Prelude PW discharge will likely have very low levels of constituents that may bioaccumulate following settlement, with no mercury detected above laboratory reporting levels (Table 9-50). Accumulation to levels that are known to cause deleterious effects on the benthos are not expected, and sediment sampling will be conducted to confirm predictions (Section 10.8.1).

Therefore, the residual impact consequence of PW discharge on benthic communities for this revision of the EP is assessed as no impact (Magnitude: 0, Sensitivity: L).

Pelagic Communities

Pelagic communities in the area surrounding the Prelude FLNG facility include plankton and pelagic fish and invertebrates. EPBC Act listed species of fish (including sharks and rays) are discussed in Section 9.9.3.3.1.

The decrease in water quality within the treated PW discharge stream may, depending on exposure duration, result in localised acute impacts to plankton. Research indicates that zooplankton exposed to low molecular weight hydrocarbons can exhibit acute toxic effects (Almeda et al. 2013; Jiang et al. 2010). In particular, PAHs are of concern due to their solubility, toxicity and relative persistence compared to BTEX. Analyses of the Prelude PW have not detected PAHs above LOR and BTEX concentrations are well below 99% species protection DGV (Section 9.9.2.2). The potential exposure to concentrations and durations of contaminants required to induce adverse effects on plankton communities will be localised to the discharge location due to the rapid dilution and decay of PW constituents in the well mixed open offshore ocean environment. Given the small area of reduced water quality as a result of the PW discharge (Section 9.9.3.2.1) relative to the ubiquitous regional distribution of planktonic communities, the dynamic nature of the plume location and the ability of plankton to recover from disturbance due to fast growth rates and/or dispersal and mixing of communities (Richardson et al. 2017) inside and outside of the PW plume, impacts on planktonic populations are expected to be insignificant.

Pelagic fish attracted to any organisms attached to the facility may be exposed to low but potentially toxic concentrations of contaminants within the PW mixing zone, including hydrocarbons and metals. Some contaminants can bioaccumulate. However, by their nature pelagic fish are highly mobile and unlikely to remain for extended periods within the discharge plume, which will vary in spatial extent and location depending on metocean conditions. Free-swimming species may also be able to detect and move away from an area of reduced water quality. The buoyant nature of the plume precludes impacts to benthic or demersal species.

Given the dynamic location and relatively small area around the release point within which the PW (whole of effluent) toxicity is predicted to fall below impact concentrations (Section 9.9.2.4), and the low numbers of any pelagic fish species expected to occur within the area of those concentrations, the potential for adverse impacts to fish communities is very low. Bakke et al. (2013), who reviewed individual, population and ecosystem level biological responses to PW, concluded that the spatial scale of impact from PW discharge was insufficient to impact populations of marine organisms.

In summary, exposure of pelagic communities to PW could result in localised effects on individual organisms, but with no ecosystem function changes or chronic level impacts to populations. The impact on pelagic communities is therefore assessed to be Slight (Magnitude: –1, Sensitivity: L).

9.9.3.2 Physical Values and Sensitivities

9.9.3.2.1 Water Quality

PW discharged from the Prelude FLNG facility will contain a range of residual contaminants, expected to include salts, hydrocarbons, metals, and production chemicals, which will have a localised effect on water quality. Physico-chemical analyses of PW samples considered to be representative of the PW that will be discharged during stable operations in early phases of production, including over the duration of this EP, shows that most contaminants are below LOR and/or require relatively few dilutions following discharge to achieve 99% SPL (Table 9-50).

The relatively low flow rate and highly buoyant nature of the PW discharge during early operations (condensed water discharge) is likely to result in high dispersion rates, with the plume restricted to the near surface waters. Dispersion modelling of the PW discharge (Section 9.9.2.4) shows that even under the least favourable conditions (lowest dilution of any simulations) the discharge plume will be diluted:

- >150 fold by the time it has travelled 50 m from the discharge location
- >1,000 fold by the time it has travelled 200 m
- >5,000 fold at 1000 m from the discharge location.

Based on the laboratory analyses of the Prelude PW, the maximum number of dilutions required for the PW discharge to meet reliable ANZG (2018) DGV for 99% species protection for any of the PW constituents is predicted to be achieved within close proximity (<50 m) of the discharge point. The relatively low levels of BTEX and, particularly, PAHs suggest that any hydrocarbons toxicity would degrade rapidly following discharge and the potential for bioaccumulation in the marine environment is limited. Similarly, the concentrations of potentially bioaccumulating metals, notably mercury, are either below detection/reporting levels or would be diluted to below DGV for 99% species protection beyond the immediate vicinity (20 m) of the discharge port. Naturally occurring radioactive materials (NORMs) are not expected to occur in quantities that may result in environmental impacts.

The low levels of MEG and occasionally amines or other process chemicals that may be present in the PW discharge would be dispersed to below impact concentrations in close proximity of the discharge location. MEG is considered readily biodegradable and non-bioaccumulative (Centre for Environment, Fisheries and Aquaculture Science 2019). The OSPAR Commission lists MEG as a substance considered to pose little or no risk to the environment (PLONOR). All process chemicals that may be discharged in PW will be subject to the Shell Australia Chemical Management Process which requires the chemicals to be substitution warning free and rated Gold, Silver, D, or E through the OCNS, listed by the OSPAR Commission as PLONOR, or have a completed ALARP assessment.

The discharge of PW is expected to be intermittent and to remain at relatively low levels for the foreseeable future. Combined with the variation in FLNG facility heading (and hence discharge orientation) and/or prevailing ocean currents at the facility location, the PW discharge plume will be dynamic and limited in spatial extent, with a significant build-up of any contaminants unlikely. Effects on water quality are therefore expected to be localised and temporary/intermittent at any location beyond the immediate vicinity of the discharge port.

Overall, the potential consequences to water quality from the PW discharge that will occur over the duration of operations with a <1 km mixing zone are considered to be Slight (Magnitude: –1, Sensitivity: L), with changes beyond relevant guideline levels for the conservation of ecological values predicted to be restricted to waters within very close proximity of the FLNG facility.

9.9.3.2.2 Sediment Quality

The PW discharge will contain a range of potential residual constituents as discussed above in Section 9.9.3.2.1. Processes by which these may become incorporated into seabed sediments include:

- sedimentation of inherent solids in the PW

- dissolved contaminants forming precipitates, which settle to the seabed
- adsorption of contaminants onto natural suspended solids, which settle to the seabed.

Sedimentation of inherent solids in the PW is expected to have little to no impact on sediment quality. The condensed water that forms most of the discharge during early phases of operation will have no to low solids content, as confirmed by physiochemical characterisation of samples to date (Table 9-49). Although solids influx in the PW stream is expected to increase once breakthrough of formation water occurs, the production process onboard the FLNG will remove most inherent solids from the PW prior to discharge. Therefore, the mass of solids discharged in the PW is expected to remain very low. Any solids not removed by processing will be very fine in size, and hence will have low settling velocities. Given the water depth at the discharge location (>230 m) and the near-surface trajectory of the (buoyant) discharge plume, the low settling velocities of inherent solids means they will be dispersed widely and will not result in significant impacts to sediment quality at any location within the currency period of this EP.

Dissolved constituents (particularly metals) in the PW may form precipitates once released into the marine environment due to changes in pH and availability of reactants (e.g. oxygen, sulphide etc.). Metals commonly encountered at elevated levels in PW that may form precipitates include barium, iron and manganese (Neff et al. 2011). These metal precipitates tend to either settle slowly and/or to be subsequently diluted below toxic levels in the water column (Neff et al. 2011). The levels of dissolved metals recorded in the Prelude PW to date have been low (Section 9.9.2.2), limiting the potential for precipitation. Solids formed by precipitation are initially very fine and will have low settling velocities. As with inherent solids released within the PW, formed precipitates are unlikely to be deposited near the discharge location and will disperse widely. Therefore, precipitates are unlikely to result in a reduction of sediment quality at or surrounding the discharge location during the period of this EP.

Some of the constituents in the PW, such as metals and hydrocarbons, may also become adsorbed onto the surface of suspended solids present in the receiving waters. However, water quality studies in the project area have shown that natural suspended sediment levels are low (Shell 2009). This is consistent with the low observed rates of natural deposition in the region as per Glenn (2004) which states that sediments locally derived from the water column are generally very fine (i.e. silt and clay sized particles). The low natural suspended sediment load indicates the potential for adsorption of potential contaminants is limited. Furthermore, the small particle size and the water depths at the FLNG location suggest any particles with adsorbed PW contaminants are likely to be effectively dispersed and diluted in the water column, with limited build up in seabed sediments around the facility and no measurable impact to sediment quality in the region.

The extent to which these processes may individually or in combination result in sedimentation of PW contaminants that affect sediment quality is also influenced by the volumes of PW discharged and the concentrations of contaminants within the discharge. Monitoring results for other offshore facilities generally show that natural dispersion processes appear to control the concentrations of potential contaminants from PW in sediments to slightly above background concentrations and below levels known to cause deleterious effects (Neff et al. 2011; Barnes et al. 2019). The discharge volumes of PW from the Prelude FLNG are expected to be relatively low for the majority of the production period, before increasing as the reservoir becomes depleted. Therefore, any credible potential for sediment quality impact is concentrated toward the end of field life for the Prelude reservoir, which is beyond this EP's currency period. Sampling of sediments is proposed to occur before this time to confirm these predictions and, if necessary, provide for implementation of management responses to ensure there are no significant changes to sediment quality due to PW discharge.

Each of the mechanisms discussed above by which contaminants in the PW may be incorporated into sediments is considered to result in no more than a Slight effect on sediment quality (Magnitude: –1, Sensitivity: L). This is consistent with monitoring results for other offshore facilities, which generally show that natural dispersion processes appear to control the concentrations of potential contaminants from PW in sediments to slightly above background concentrations (Neff et al. 2011).

9.9.3.3 Natural Values and Sensitivities

9.9.3.3.1 Threatened, Migratory, Marine and Cetacean Species

As the PW discharge will be 5 m below the water line, it is expected to be positively buoyant for most of field life and not predicted to affect water quality at depths beyond 16 m at any stage, pelagic fauna that are at or

near the sea surface are most likely to be exposed to the PW plume. The plume is dynamic and moving constantly depending on the FLNG facility heading, currents, winds and internal waves. Consequently, transient biota such as migrating whales or whale sharks are unlikely to be exposed to elevated contaminant concentrations for extended durations.

Most EPBC Act listed species within the area predicted to be influenced by the PW discharge are air breathing vertebrates (e.g. marine turtles and mammals), which are unlikely to be directly affected as their skin is relatively impermeable and they do not possess gill structures that facilitate cellular uptake of dissolved seawater constituents. Hence, significant direct impacts to these fauna are not considered credible. Indirect effects, such as via altered prey abundance or ingestion of bioaccumulated toxic compounds, are not considered to have the potential for adverse impacts to marine turtles or mammals given the localised area predicted to be influenced by PW, the absence of feeding BIAs within this area, the typically temporary or transitory presence of threatened fauna species, and the nature and scale of impacts to the marine ecosystem within the PW discharge plume (e.g. Slight impacts to plankton). Other EPBC Act listed species (e.g. pelagic sharks, fish or rays) are not expected to have significant exposure to high concentrations of PW and may actively move away from areas of reduced water quality, which will be localised to the vicinity of the release location. Fish, including sharks and rays, are more susceptible to impacts from changes in water quality. However, there are no aggregation areas for any species of fish, sharks or rays within areas credibly affected by Preludes PW and threatened or migratory species that may occur coincident with PW discharges are highly mobile and widely distributed.

There are no known aggregation areas or BIAs for these species within the area potentially affected by PW discharge. The closest BIA relates to low density whale shark foraging, which is ~17 km away.

Given the absence of impacts to higher order marine fauna, limited spatial extent of water quality impacts (within 1 km from the FLNG), the infrequent and likely short duration (i.e. minutes at a time) of interaction with the PW plume, and that only a very small proportion of a migrating/foraging population of any threatened or migratory species would credibly intersect the discharge plume, impacts are expected to be slight at worst (Magnitude: -1, Sensitivity: M).

9.9.3.4 Socioeconomic Features, Values and Sensitivities

9.9.3.4.1 Fishing Industry

The PW discharge plume overlaps the authorised fishing zone of several commercial fisheries, however, catch data and consultation indicate only activity in the WA-managed Northern Demersal Scalefish and (possibly) the Mackerel fisheries may occur in the waters surrounding the FLNG facility. No unauthorised vessels, including fishing vessels, will be permitted to access the 500 m PSZ around the Prelude FLNG vessel during the operational life of the facility, and therefore there will be no access to the area immediately surrounding the PW discharge location over the duration of this EP. While the discharge of PW may lead to the introduction of contaminants with the potential for bioaccumulation, this is not expected to occur in organisms beyond the immediate area of the FLNG facility (e.g. organisms that have colonised the hull). The PW discharge modelling indicates that, for the PW discharged over the duration of this EP, elevated (i.e. above guidelines) levels of contaminants will be restricted to near surface waters <50 m from the discharge point.

The Northern Demersal Scalefish fishery does not target species that may occur in the near surface waters that are potentially affected by the PW discharge. Effort in the Mackerel Fishery is concentrated in coastal areas around reefs, shoals and headlands. The highly mobile and widely dispersed pelagic fish targeted by the Mackerel Fishery are unlikely to remain within the discharge plume for sufficient time and/or in sufficient numbers for the fishery stocks to be adversely affected. Therefore, no impacts to these fisheries are anticipated (Magnitude: 0, Sensitivity: L).

9.9.3.5 Cumulative Impacts

The discharge of PW has the potential for cumulative effects due to other planned discharges to the marine environment associated with FLNG operations, such as cooling water and effluent streams (Section 9.10), and/or through combination with discharges from other users or facilities in the immediate region.

Apart from cooling water, the other FLNG liquid discharges typically involve relatively low volumes and/or do not contain constituents that would result in cumulative impacts with PW. For example, BTEX, an aromatic hydrocarbon component of the PW discharge that may also be present in the Drainage and Bilge Wastes

discharge, will rapidly degrade and does not significantly bioaccumulate (Neff 2002). Modelling indicates that the area affected by TPH in the comingled discharges would not materially change from that for the PW discharge alone (RPS 2019b). The cooling water discharge outlets on the FLNG facility are located at the opposite end of the vessel, ~420 m from the PW discharge point. However, under certain metocean conditions, the discharge streams will overlap. The potential for residual chemicals in the cooling water discharge to interact with contaminants in the PW stream and increase the toxicity of the comingled effluent plume was investigated via DTA. The results showed that there was negligible change in overall toxicity, and no change to the required mixing zone to achieve 99% species protection (AIMS 2025).

The potential for PW discharge to interact with other users or facilities in the immediate region is limited by the rapid dispersion and associated reduction in contaminant concentrations that will occur following discharge. Conservative modelling of the PW discharge for early FLNG operations predicts that the concentrations of the identified key contaminants in the PW would fall below ANZG guideline 99% species protection thresholds within a radius of <50 m from the discharge location (Section 9.9.3.2.1) and DTA results suggest effects on water quality are unlikely to extend beyond 1 km of the platform. Bakke et al. (2013) states that typically no impacts are detected beyond 2 km from offshore facilities around the world. Non-project related usage within this area is expected to be minimal, particularly noting that there will be a 500 m radius vessel exclusion zone around the operating FLNG facility.

Of the other operating oil and gas production facilities in the region, the Ichthys facilities are the closest, situated approximately 20 km south of the Activity Area. The Montara facility is located approximately 188 km north-east of the Activity Area and, once commissioned, the Crux platform will be operating ~165 km away. Planned discharges from these facilities are reported to disperse rapidly within close proximity of discharge points (Inpex 2022; Jadestone Energy 2023; Shell 2024) and the combined area within the region potentially affected by liquid discharges from all of these facilities (inclusive of Prelude) represents a negligible proportion of the regional open ocean environment.

Given the localised mixing zone(s) for the Prelude discharges, limited synergistic effects of comingling and distances to other sources of reduced water quality in the region, no significant cumulative impacts from planned discharges of PW are expected for the activity, and no change to the overall consequence level identified for PW discharge is expected to result.

9.9.4 Impact Assessment Summary

Table 9-57 lists the highest impact consequence rating in the relevant environmental receptor groups.

Table 9-57: PW Discharge Evaluation of Impacts

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Evaluation – Planned Impacts			
Protected Areas	N/A	N/A	N/A
Physical Features	N/A	N/A	N/A
Physical Values and Sensitivities	−1	L	Slight
Natural Features	−1	L	Slight
Natural Values and Sensitivities	-1	M	Slight
Socioeconomic Features	0	L	No Impact
Socioeconomic Values and Sensitivities	0	L	No Impact
Heritage and Cultural Features	N/A	N/A	N/A
Heritage and Cultural Values and Sensitivities	N/A	N/A	N/A

9.9.5 ALARP Assessment and Environmental Performance Standards

Table 9-58: Produced Water - Discharge ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	Re-injection of produced water.	No	Assessment of onboard treatment and overboard disposal versus produced water re-injection was undertaken during the design phase of the project. The assessment supported the use of the onboard treatment based on the following: • Produced water reinjection systems require significant additional capital and operational expenditure with an associated increase in manning levels. • Produced water re-injection pumps are a source of high noise levels in their immediate vicinity and contribute to the overall noise footprint. • Lower power demand for the onboard treatment versus reinjection, therefore lower CO2 emissions. • For the reinjection option, the produced water treatment facilities remain the same, in line with overboard disposal, due to capability of overboard disposal in case the water re-injection system is down, therefore, there are no equipment reduction benefits for the re-injection option. According to other facilities worldwide, re-injection facilities have on average 80% availability. • There is potential risk of reservoir souring/scaling due to water re-injection. The availability of reservoir for re-injection near the Prelude field without fracking or souring is very limited. Given the slight residual impact predicted for PW discharge, the overall costs (including HSE impacts/risks) are considered grossly disproportional to any environmental benefit.	N/A	N/A	N/A
Elimination	Collection and storage of PW for onshore disposal.	No	As above, an assessment of all feasible PW disposal alternatives/options available was conducted during the design phase of the project. The onshore additional treatment and disposal of PW would result in significant additional safety, environmental, logistical, operational and financial costs. To enable sufficient storage, extra tanks, either permanent or temporary would be required on the FLNG, imposing additional space and weight requirements, which were not factored into the original design of the facility. The transferring of the contents of the tanks, or the tanks themselves, to support vessels would then require increased handling and lifting operations, therefore exposing personnel to additional health and safety risks. It would also introduce substantial additional costs and increase discharges/emissions (e.g. GHG, vessel discharges) and increases in HSE risks, including oil spill. Additionally, limited onshore facilities are available to treat, recycle, and/or dispose of such fluids. Costs would primarily relate to the storage requirements of the PW on the FLNG (as opposed to discharging), prior to transport to shore. There is negligible or no environmental benefit given the PW would still need to be disposed elsewhere and the low impact associated with the discharge of treated PW, and it is therefore not considered a reasonably practicable alternative. Additionally the overall costs and HSE impacts/risks are considered grossly disproportionate to any environmental benefit.	N/A	N/A	N/A
Substitution	Alternative technology to MPPE system.	No	The MPPE technology was chosen based on a Best Available Technology (BAT) assessment during the design phase of the project. Alternatives to MPPE are steam stripping, adsorption to activated carbon, advanced filtration, bio-treatment, the use of hydrocyclones, Induced Gas Floatation (IGF) or advanced oxidation. None of the practicable alternative systems would offer improved treatment performance and operability advantages over MPPE. It is also noted that MPPE units have been selected as the preferred technology on other recent facilities.	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Engineering, Administrative and Procedural	PW treatment and monitoring system which includes: • LP Separator • PW Flash Gas Vessel • MPPE Treatment System • Online TPH analyser • Monitoring of TPH concentration via DCS with alarms • PW flowmeter • Onboard storage in the PW buffer tank including recirculation capability • Ability to conduct manual sampling if the online analyser is unavailable • Onboard laboratory monitoring of mercury concentrations in the PW • Proactive Technical Monitoring (PTM) as defined in Section 10.5.6.11 • Maintenance of the system in accordance with CMMS as defined in Section 10.5.8 and 10.5.9.	Yes	**LP Separator (V-10012)** PW first undergoes bulk separation in the LP separator (V-10012), which is a three-phase separator to facilitate water, hydrocarbon liquid and gas separation. From here the water is sent to the PW flash gas vessel for further treatment, the gas is routed to the condensate stabiliser overhead compressor and the separated condensate is routed to the downstream parallel condensate stabilisation trains. **PW Flash Gas Vessel** The PW Flash Gas Vessel receives the water from the LP separator and from other intermittent streams (refer to Table 6-4) and achieves degassing, primary hydrocarbon removal and cooling. The pressure in the vessel is reduced to the LP wet flare operating pressure, which degasses the dissolved hydrocarbon in the produced water inlet streams. Skimmed oil is sent to off-spec tanks (T-10001A/B) for further re-processing. The degassed stream is then cooled to 34ºC by the produced water cooler; this is the optimum temperature for efficiency of the downstream MPPE. The PW is then stored in the PW Buffer Tank, before being processed in the MPPE unit. **MPPE Treatment System** MPPE was listed as BAT by the OSPAR convention for the protection of the marine environment of the North-East Atlantic (1999) for produced water management on offshore oil and gas platforms based on the following: • Unlike other methods, MPPE technology removes dispersed and dissolved components effectively. • The effective reclamation procedure of the MPPE material makes it suitable for removal of high quantities of dispersed and dissolved hydrocarbon from wastewater but without the generation of significant waste streams (e.g. spent adsorbents). • The MPPE technology has an effective regeneration process such that one column can operate automatically while another column is regenerating at the same time. • The MPPE unit operates automatically and operator attention is limited. High availability of the system ensures that incidents of non-compliant discharge are minimised if not prevented. The change-out of the MPPE columns is included in the maintenance program. Two by 100%-capacity MPPE systems are installed on the FLNG (one in extraction, one in regeneration and two in stand-by) to ensure high availability of the system. MPPE columns are anticipated to be sent onshore for media replacement every 2 to 4 years during normal operations. The effectiveness of the MPPE treatment was confirmed as part of the Prelude PW studies completed by Shell under the previous revision of the EP. Results of post-treatment PW showed markedly lower toxicity than untreated PW in Microtox® screening, and significantly lower concentrations of mono- and poly-cyclic aromatic hydrocarbons (MAH and PAH) and TRH/TPH. **TPH Limit** To date, average oil in water concentrations have been relatively low, with an average range between <1.5 and 8.5 mg/L. As a demonstration of continuous improvement a revised target of 20mg/L (down from 30mg/L) has been adopted for the period of this EP. This is considered to be a conservative limit, but has been based on the following uncertainties associated with the introduction of Crux gas and reservoir behaviours:	7.1	Produced water TPH content of the discharge shall not exceed 20 mg/L (daily average).	PW records demonstrate TPH levels do not exceed 20 mg/L (daily average).
				7.2	The new on-line analyser for monitoring TPH in PW will be installed and operational by the end of Q1 2026.	Evidence of analyser installation and operation.
				7.3	PW discharge is monitored via DCS by an operator with assistance of PW TPH high alarms set at 20 mg/L (24hr average) and 30 mg/L (instantaneous), which automatically divert the PW inboard to the PW buffer tank for re-treatment.	DCS/PI records of PW discharge trends and responses to PW TPH high alarm. Alarm register shows high alarm in place on the PW TPH analyser.
				7.4	When discharging PW, if the online analyser is not available; conduct manual lab analysis once per shift when discharging. Results will be used to verify that the PW TPH concentration does not exceed the defined limits.	Laboratory sample records confirm that the PW TPH concentration levels do not exceed 20 mg/L (daily average).
				7.5	A review of TPH discharge limits is conducted every 12 months following the introduction of Crux gas on Prelude, and will include: • A 12-month review of TPH monitoring data • An assessment detailing if a reduced operational target for the following 12 months, to be monitored via PTM, can be implemented.	Note for File (or similar) documenting the review and recommended actions. PTM records show monitoring of TPH operational target.
				7.6	PW density and discharge rates are monitored via PTM to inform adaptive management actions associated with increased formation water breakthrough and/or increased discharge rates.	PTM records of PW density and discharge rate trends using DCS/PI and laboratory data. Evidence of AMMF implementation.
				7.7	PW related ECEs including: • MPPE units • TPH on-line analyser are prioritised, maintained and confirmed to be functioning in accordance with the CMMS.	PW related ECE CMMS records.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			• With Crux coming online there will be decreased residence time in the LP separator (V10012) which has the potential to impact separation efficiency. • Small amounts of corrosion inhibitor, injected to protect the Crux export pipeline will be imported to Prelude through the hydrocarbon export stream, and may create an emulsion in the LP separator which could impact separation efficiency. • The risk of an unexpected increase in the predicted amount of formation water breakthrough, resulting in changes to PW chemistry. • Fluctuations in volumes and TPH concentrations of process sources (refer to Table 6-4) to the PW buffer tank. However, to ensure that TPH levels in the PW are always ALARP, a review of the TPH limit will be undertaken every 12 months, following the first 12 months of processing of Crux gas on Prelude, to assess if the limit can be reduced for the following 12 months. Any reduced limit will be managed as an internal operational target with PTM used to monitored progress against the revised target. **TPH Monitoring** Monitoring of the OIW content of PW provides information on the performance of the PW treatment system needed to help ensure discharge limits are being achieved. The Prelude facility has an online OIW analyser that provides real time readings to determine TPH content and ensure off-specification water is redirected inboard for further treatment. Verification, validation and maintenance of the OIW analyser ensures that the monitor is operating within an acceptable tolerance of accuracy. Oil in water analysis requirements are defined in Prelude FLNG Oil in Water Analysis Terminology and Methodology (HSE_PRE_16227). Monitoring of PW discharge by an operator via the Distributed Control System (DCS) allows PW treatment performance to be confirmed during operations. These equipment and personnel control measures are implemented 24/7. A dedicated buffer tank, with ~5400 m^3 capacity, is provided on the FLNG facility and means that PW that does not meet specifications can be collected rather than discharged. The PW can then be reprocessed through the MPPE to ensure that the TPH content of the discharge stream is below the required limit and the potential for impacts is minimised. High alarms set at 20mg/L (24hr average) and 30mg/L (instantaneous) automatically divert the PW inboard back to the PW buffer tank to ensure that the daily average limit is met. The onboard storage also allows for production to continue during troubleshooting and/or repairs in the event of treatment system upsets or downtime. Further redundancy is provided by the option to route the PW to the Slops system storage in the event that the MPPE system is not available. The online analyser (Manufacturer: ASI KECO; Model: 204) originally installed onboard Prelude during the project phase was identified as not being fit for purpose and has not been operational since 2021. As a result manual sampling approximately every six hours, while discharging, has been undertaken to ensure that the TPH limit of 30mg/L (24 hour average) and 42 mg/L (instantaneous) was being met. A project to replace the on-line analyser with a new OIW analyser was initiated in 2023, with scheduled installation in Q1 2026. The new analyser (Inov8 EXS) uses Deep-UV (ultraviolet) fluorescence method to measure OIW content directly in the produced water liquid phase. UV fluorescence method is widely used in the offshore oil in gas industry in Australia and around the world. The analyser replacement project includes the following major activities: • Decommissioning of existing analyser ASI KECO 204 and removal from cubicle B-82001H.			

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			• Designing, procurement and installation of new sample system and lab sample point. • Installation of new analyser inside cubicle B-82001H. • Installation of sample take off probe into existing sample take off point. • Update of engineering drawings. • Update of maintenance procedures. The on-line analyser is categorised as an ECE (see Section 10.5.2) and is maintained in accordance with the CMMS (as detailed in Section 10.5.8 and 10.5.9) to ensure its reliability and availability. If manual sampling is required, samples will be taken once per shift, whilst discharging, to confirm the revised TPH limit of 20 mg/L (24hr average) is achieved if the on-line analyser is not available (eg due to maintenance or downtime), An internationally recognised method such as ASTM, ISO or equivalent for TPH determination will be used for routine oil in water determination in the lab. Once per shift sampling during discharge is deemed representative as well as considered a practicable level to ensure sampling and analyses personnel are able to fulfil all of their other roles and responsibilities. This reduction in sampling frequency is justified due to the lack of variability observed during the periods that six hourly samples were taken. Furthermore, manual sampling is conducted in the MMPE room, which is a hot and uncomfortable environment, the lowering of the sample frequency prevents the unnecessary exposure of personnel to this environment, balancing operational safety with the need for representative monitoring data. Documented maintenance programs in accordance with the CMMS (Section 10.5.8 and 10.5.9) are in place for key PW equipment on the facility. Through ongoing maintenance, the operability of the relevant systems and equipment is optimised, reducing the risk of inadequate PW treatment, monitoring and management.			
			Mercury Mercury is a highly volatile element that has a strong affinity for organic matter. It is soluble in natural gas and condensates and present in hydrocarbon basins globally, exhibiting a wide range of concentrations. The physical, chemical and geochemical properties of mercury create complex distributions in hydrocarbon	7.8	During Prelude only production, PW is diverted inboard to the PW Buffer Tank if a mercury concentration above 1 µg/L is detected.	Laboratory sample records confirm that the PW mercury concentration levels do not exceed the 1 µg/L, or if it does, evidence that PW is diverted inboard.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			systems. Through the process of thermal evolution, mercury concentration in hydrocarbons can be influenced by source rock origin, migration pathway and fluid chemistry. To date mercury levels in the PW have been below the detection limit of 0.05 µg/L, with the exception of one sample which recorded 0.06 µg/L. A mercury partitioning study undertaken looked at the expected mercury concentration in the PW discharge for both Prelude only and Prelude plus Crux cases. The study predicted mercury concentrations in the Prelude only case to be <2 µg/L, which indicates that the solubility of elemental mercury in water is over-predicted by the model. Post addition of Crux gas, the mercury content in the PW is predicted to increase to 4.3 µg/L. Crux fluids do not contain a free aqueous phase, however, Crux condensate and Prelude liquids (inclusive of condensate and produced water) are co-mingled in LP Separator V-10012. The model assumes perfect mixing and that a perfect equilibrium between condensate, water, and mercury is achieved in V-10012, and therefore that the mercury arriving in the Crux condensate partitions into the Prelude PW in V-10012. This perfect mixing is unlikely and the model likely over predicts mercury solubility in water. Therefore actual mercury content in PW is expected to be lower. An additional case which assumes a cold Crux arrival temperature due to pipeline packing and MEG injection was also assessed, with an increase of mercury in water to 6.3 µg/L (a 75% increase). This is assumed to be partly due to the increased mercury concentration of the Crux condensate phase in V-10012, and partly due to the increased solubility of mercury in the aqueous phase in the presence of MEG. Therefore a worst-case mercury concentration of 6.3 µg/L is precited by the model, however again it is expected that the model likely over estimates the mercury concentrations. There is some evidence from the MPPE vendor (Veolia), based on results from other operating units and pilot tests, that the MPPE units are capable of removing total mercury (elemental ionic and organic) at a rate of >90%. However the mechanism for removal is not clear and there is currently no evidence to support that this level of removal efficiency is applicable to Prelude. Mercury concentrations at the inlet to the MPPE have been regularly sampled for by the offshore laboratory since 2021 (every 2 weeks), with all but four results (2 in 2021 – measured at 1 µg/L and 2 in 2024 – measured at 0.6 and 0.54 µg/L), recording levels below the laboratory detection limit of 0.5 µg/L. Similarly, for samples taken at the outlet of the MPPE of the PW discharged overboard, all but one result have been below the onshore laboratory detection limit of 0.05 µg/L. Based on these results and the partitioning model predicted concentration of 2 µg/L, a conservative end of pipe concentration level for Prelude only production of 1 µg/L has been applied. This is due to the unknown mercury removal efficiency of the MPPE, and that the absence of mercury in the PW to date, does not preclude that an increase in mercury concentration may occur. Samples taken at the inlet to the MPPE will continue to be taken and analysed by the offshore laboratory every 2 weeks. If an inlet concentration above the detection limit of 0.5 µg/L is recorded this will trigger a sample of the MPPE outlet to determine the overboard discharge concentration and confirm that it is below the 1 µg/L limit. If an overboard discharge concentration of above 1 µg/L (Prelude only) is recorded the PW water will be diverted inboard to the PW buffer tank for re-treatment.	7.9	Following the introduction of Crux gas, PW is diverted inboard to the PW Buffer Tank if a mercury concentration above 6.5 µg/L is detected.	Laboratory sample records confirm that the PW mercury concentration levels do not exceed the 6.5 µg/L, or if it does, evidence that PW is diverted inboard.
				7.10	Onboard manual laboratory sampling and analysis of PW mercury concentration at the inlet of the MPPE is taken at the following frequencies: • every 2 weeks during Prelude only production • weekly for the first 12 months following the introduction of Crux gas, with frequency adjusted to a maximum of 2 weekly if supported by the review in EPS 7.11 If the mercury concentration is detected above the detection limit of 0.5 µg /L a sample at the outlet of the MPPE is taken.	Laboratory sample records including MPPE outlet samples if inlet sample is above detection limit.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			Following the introduction of Crux gas the mercury limit is increased to 6.5 µg/L to reflect the worst-case predicted concentration identified in the partitioning study (Section 9.9.2.2.1). At these concentrations the overall load to the environment remains low at <1 kg/yr and the mercury PC99 value of 0.1 µg/L would be achieved within 50 m of the discharge location. Given the current uncertainty regarding the amount of mercury expected as a result of the introduction of Crux gas, sampling and analysis will be increased to weekly with the same trigger to sample at the MPPE outlet if the detection limit of 0.5 µg/L is exceeded. If an overboard discharge concentration of above 6.5 µg/L is recorded the PW water will be diverted inboard to the PW buffer tank for re-treatment. However, to ensure that mercury concentrations are reduced to ALARP and acceptable levels, and to comply with the obligations of the Minamata Convention Article 9 in 'controlling and where feasible reducing the release of mercury to land and water (SMCM, 2024), Shell commit to conducting 12 monthly reviews of mercury concentrations, following the first 12 months of processing of Crux gas on Prelude, which will include: • an assessment of the efficiency of mercury removal through the MPPE • an assessment of the appropriateness of the mercury sampling frequency • an assessment detailing if a reduced operational target for the following 12 months, to be monitored via PTM, can be implemented. Additionally the knowledge gained through the periodic reviews of mercury removal technology to be undertaken in accordance with EPS 7.31, as referenced in the Crux Completions, Hot Commissioning, Start-up and Operation EP, will be leveraged to identify and implement any potentially feasible and ALARP solutions.	7.11	Following the introduction of Crux gas 12 monthly reviews of mercury data will be undertaken to: • assess the efficiency of mercury removal through the MPPE • assess the appropriateness of the mercury sampling frequency • to establish if a reduced operational target, to be monitored via PTM, can be implemented.	Note for File (or similar) documenting the review and recommended actions. PTM records show monitoring of mercury operational target.
Engineering, Administrative and Procedural	MEG management and reprocessing to limit concentrations of MEG discharged through the PW system, including use of: • 3 Rich MEG tanks for storage • MEG Analyser • Engineering calculations • MOC process defined in Section 10.4.4 • Maintenance of the system in accordance with CMMS defined in Section 10.5.8 and 10.5.9.	Yes	Prelude uses MEG to mitigate the risk of hydrate formation in the subsea and topsides facilities during shutdown and re-start operations. The original Prelude design intent was to create Rich MEG ullage by regenerating the Rich MEG to Lean MEG, however the MEG regeneration package has not been commissioned and has been the subject of a long-term solution investigation. Options considered as part of the study and their outcomes are described below: • **Commission the MEG regeneration package** – this option was not recommended due to various factors including the lengthy commissioning period, reliability concerns, lower than expected Rich MEG concentration (unit design for 45% MEG feed vs actual range of 1-5% MEG) which will significantly impact unit performance, limit feasible recovery, large CAPEX (~USD$10 million) and additional operational manhours (estimated at 19-25 hrs/week). The decommissioning options for the package are currently being assessed. • **Onshore re-processing of MEG** – a facility in Darwin is capable of processing rich MEG to recover lean MEG. Onshore re-processing would require numerous transfers of rich MEG to supply vessels, and given the low concentrations of MEG (1-5%) in large volumes of water, only small amounts of MEG would ultimately be recovered. With a re-processing cost of ~AUD$1/L, re-processing of the contents of one rich MEG tank (6,000 m3) would require a minimum of ~7 transfers via PSV (vessels are limited to be able to carry 800 m3 of a contaminated product under IMO requirements, which would need to be split across 6 mud tanks in the vessel) and a cost of AUD$6 million. This would require physical handling of the rich MEG across multiple interfaces including offshore, at port, and to deliver to the facility. Furthermore, the facility requires rich MEG to be over 5wt% concentration to allow for efficient reprocessing through their equipment. This solution is therefore not considered an economically, operationally or environmentally ALARP option for the long term-reprocessing of MEG from Prelude given the increased health and safety risks due to the additional handling and lifting	7.12	A MEG concentration of ≤1% in the PW discharge will be maintained.	DCS/PI records demonstrate that MEG concentration records do not exceed 1%.
				7.13	MEG concentration, measured by the MEG analyser, upstream of the PW buffer tank, is monitored via DCS by an operator by with an alarm set at 1%.	DCS/PI records of MEG concentration trends and responses to alarm. Alarm register shows alarm in place.
				7.14	In the event that Rich MEG tank ullage becomes constrained and there is a risk of a facility shutdown, MEG may be required to be discharged at concentrations ≤5% until sufficient ullage is obtained. In the event that this is required the MOC process will be followed to ensure that MEG discharge is ALARP and that compliance with EPS 7.19 is maintained.	MOC records with demonstration of ALARP. MEG concentration lab records.
				7.15	If the MEG analyser is out of service a mass balance calculation is used to estimate MEG concentration in the PW buffer tank. Manual samples will be taken every 24hrs while discharging to validate the MEG concentration.	Mass balance calculation records. Laboratory sample records confirm that the MEG concentration levels do not exceed 1%.
				7.16	The MEG Analyser is categorised as an ECE and is prioritised, maintained and confirmed as functional in accordance with the CMMS.	MEG Analyser CMMS maintenance records.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			operations, and the increased discharges/emissions (e.g. GHG, vessel discharges) incurred with the additional logistics. • **Discharge of rich MEG (<1%) with the PW** – following the outcomes of the PW monitoring, modelling and investigations discussed in Section 9.9.2, which included the development of a site specific GV for MEG following Australian standards as well as mechanistic toxicity modelling, a rich MEG concentration of <1% in the PW discharge was identified as having minimal impact on the overall toxicity of the PW and ensuring compliance with EPS 7.14. MEG injection is required under the following scenarios, with the first four cases making up the primary use of MEG during shutdown, start-up, ramp-up and normal operations: • Before a planned shutdown • When plant is down after any planned or unplanned shutdown (at each well) • During any start-up • To pre-treat flowlines in the event of an unplanned shutdown • During gas sweeping operations (before start-up) • For well annulus management, during normal operation • Whenever flaring from the HP separators or AGRU Feed separator • For subsea and turret valve leak-off testing • Unplanned hydrate remediation on the subsea or topsides. Post Crux start-up, additional scenarios for MEG injection at Prelude FLNG will include: • During pressurisation of Prelude topsides with Crux pipeline gas before start-up • During any start-up and ramp-up of the Crux pipeline • Pre-filling of HP Separator V-10011 before any Crux start-up to clear low level trips • In response to off-spec arrival of Crux fluids • During pipeline packed operation • During loss of heating During periods of MEG injection, the MEG content in PW from U46000 is monitored and PW is routed to the rich MEG tanks if required to ensure MEG concentration in the PW buffer tank does not exceed 1%. There are two rich MEG tanks in the substructure with a capacity of 6000 m^3 each and one forward rich MEG tank with a capacity of 2000 m^3. The concentration of MEG in PW is monitored via an online analyser which is in place upstream of the PW water buffer tank. A DCS alarm set at 1%, ensures that water with a MEG content above 1% is directed to the rich MEG tanks rather than being sent to the PW buffer tank and therefore PW with a MEG content >1% will not be discharged overboard. In the event that the MEG analyser is unavailable, a mass balance calculation is used to estimate the MEG concentration in the PW buffer tank. To perform the mass balance calculation, the total volume and MEG concentration in the produced water buffer tank (T-64001) are first determined. The quantity of Lean MEG injected is then conservatively assumed to be fully added to the tank contents, without taking credit for additional water returning from the wells. If the projected MEG concentration in the buffer tank remains below the overboard discharge limit, the produced water stream remains lined up to the buffer tank. However, if the projected concentration exceeds the discharge limit or cannot be reliably determined, manual sampling at the outlet of the flash gas vessel will be required.			

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			Operationally, ~2,600 m^3 of ullage is required at all times in the rich MEG tanks to allow for an unplanned trip, which will increase to ~4,200 m^3 post Crux start-up. The discharge of rich MEG to the PW buffer tank therefore must be managed such that the discharge limit is achieved and sufficient ullage is maintained. If rich MEG tank ullage becomes constrained (which may occur due to increased facility shut downs/start-ups and the need to conduct RBIs of the tanks) and there is a risk of insufficient ullage should a trip occur, MEG may be required to be discharged at a concentration of ≤5%. This will be managed via an MOC and will ensure that the concentration of MEG discharged is such that compliance with EPS 7.15 is maintained.			
Engineering, Administrative and Procedural	Management of amine concentration in the PW discharge.	Yes	During normal operation there is a continuous water stream from the dehydration unit (U13000) that is potentially contaminated with low amine concentration. The design is that this stream is routed back to the AGRU via the amine drain drum V-11005. There is an option to route this water stream to the Produced Water Flash Gas Vessel (V-64031), which would route this water through the MPPE unit and discharge overboard. Dust from U13000 media which is captured in the U13000 water can contribute to upsets in the AGRU, resulting in foaming events which have the potential to cause facility trips and even damage to dehydration unit media. Prior to the WET/DTA testing conducted in 2022 and 2023 which identified higher than expected toxicity (see Section 9.9.2.3), it was not appreciated that the water from U13000 contained amine carried over from the AGRU (no measurements for amine in produced water had been previously conducted). Once it was established that there was some small amine content in the PW, which was traced back to water from V-13001, this stream was immediately stopped and was routed back to AGRU. Currently, under normal operations no amine contaminated water from V-13001/V-13002 is directed to the PW flash gas vessel. There remains, however, a few scenarios under which amine contaminated water may need to be routed to the PW. These include: • During the first startup after a dehydration unit media replacement (only performed in Turn Around, ~once every four years). This due to expect high levels of dust from the dehydration beds which would be present in water from V-13002 and if routed to V-11005 (AGRU) could contaminate the total amine inventory and may introduce long term foaming and process upset issues; and • If it was not possible (because of a failure of a pump, valve or other equipment, etc) to move the water from V-11005, which would result in the shutdown U13000 and subsequently the cold end of the facility. Only under similar conditions of impending facility upset or shutdown would it be considered to route the U13000 water to V-64031. Any diversion of amine contaminated water from V-13001/V-13002 to the PW flash gas vessel requires login by the DCS Supervisor. If the U13000 water were to contaminate (or expected to contaminate) the water leaving V-64031 (Produced Water Flash Vessel) with amine, then this contaminated produced water is routed to the contaminated rich MEG tank. The contents of the contaminated Rich MEG tank will then be sampled to determine the concentration of amine and the allowable reprocessing rate to ensure the concentration of amine in the PW buffer tank remains below 15mg/L.	7.17	If the contents of the contaminated rich MEG tank is required to be discharged with the PW, the amine concentration will not exceed 15mg/L in the discharge to maintain compliance with EPS 7.19. A mass balance calculation will be used to determine the amine concentration with lab samples taken every 24hrs while discharging to validate amine concentration limit is met.	Mass balance calculation records. Laboratory sample records confirm that the amine concentration levels do not exceed 15mg/L.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Administrative and Procedural	Prelude FLNG PW Adaptive Monitoring and Management Framework (AMMF). The AMMF includes: • Requirements for monitoring of the PW. • Triggers for further assessment of the impacts and risks of PW and actions to be taken. • Actions to build confidence around impacts occurring.	Yes	The implementation of AMMF for PW discharges (further described in Section 10.8.1) is a system control measure that allows for continuous improvement and ensures that PW management measures are updated appropriately based on new information and changing conditions, allowing for more effective and responsive management of the PW discharge. It also accounts for adaptive management actions; and potential changes in the PW characteristics which are likely to change in some respects over time. The AMMF program comprises the following components: • Topsides monitoring, analysis, and review, including TPH and mercury • DTA/Whole Effluent Toxicity (WET) testing • Triggers for further assessment of the impacts and risks of the PW discharge • Contingency/management actions, as required The program ensures the extent and effect of the PW discharge and associated contaminants are assessed, and where practicable, allows adaptive management changes to occur. The monitoring and adaptive management included in this revision of the Prelude EP is based on the outcomes of the previous EPs AMMF and the recommendations made by AIMS following their comprehensive study “Risk based assessment of Prelude’s produced water discharges: partnering to grow science certainty – Final Synthesis report (Fisher et all 2025). Additional consideration has also been given to the introduction of Crux gas on Prelude and the uncertainty with regard to potential changes in TPH and mercury concentrations. The revised mixing zone for PW has been estimated based on the revised PW discharge modelling and the outcomes of the PW WET tests undertaken between 2021 and 2024 (see Section 9.9.2). Of the four WET tests conducted the number of dilutions required to meet PC99 values ranged between 12,346 and 2,941. Based on the results of the revised modelling PC99 values would be met for all WET results at 700m from the stern of Prelude (equivalent to ~1100 m from the discharge location reference in Table 9-54) using the mean dilution figures (calculated by pooling all 5th percentile dilutions). Assuming worst-case dilution (the lowest 5th percentile of dilutions) only WET test 4 would meet the PC99 value at the edge of the 700m mixing zone. A conservative mixing zone boundary of 700m from the stern of Prelude has therefore been established for meeting the PC99 value determined by DTA testing assuming the mean 5th percentile number of dilutions. To meet PC95 values dilutions of between 3,695 and 238 are required across all WET test rounds. These values would all be met within a mixing zone boundary of 200 m from the stern of Prelude.	7.18	Implement monitoring of PW in accordance with the AMMF (Table 1) including: • chemical characterisation (quarterly) • mercury concentration (see EPS 7.10) • full suite DTA (twice in Year 1 and annually thereafter) • 2 Species DTA (twice in Year 1 and three times per year thereafter) • sediment monitoring (by 2030 or sooner)	AMMF monitoring and implementation records.
				7.19	PW discharge will not exceed the PC95 and PC99 values as determined by DTA at the edge of the mixing zone boundaries 200m and 700m from the stern of Prelude, respectively.	
				7.20	Implement adaptive management actions as required in accordance with the AMMF.	
Administrative and Procedural	Conduct annual field water quality monitoring.	No	Shell monitors many aspects of PW discharge on the Prelude topsides through ongoing online analysers (flow and OIW), sampling and lab analysis, and periodic DTA and chemical characterisation. Combined with modelling, this information provides a robust understanding, with significant conservatism, of the likely levels of environmental impacts on the receiving environment from the discharge. Annual field monitoring would provide only a snapshot of receiving water quality with limited additional value to management of the discharge and is a very time consuming and expensive activity, which introduces substantive HSE risks. Given the low risk of impacts from PW discharge during the 5 year life of this EP, the costs associated with annual field water quality monitoring are considered grossly disproportionate to any environmental benefit.	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria

Administrative and Procedural	Shell Australia Chemical Management Process.	Yes	Shell has adopted a chemical selection and approval process in accordance with Shell's chemical selection and approval guidelines (as outlined in the Shell Australia Chemical Management Process and Shell Global Product Stewardship guidelines) to assess chemicals that may pose a risk of environmental impact via planned discharges.
			In addition, Shell complies with the Industrial Chemicals Environmental Management (Register) Act 2021 and associated legislative instruments, including the Industrial Chemicals Environmental Management (Register) Instrument 2022, which establish the Industrial Chemicals Environmental Management Standard (IChEMS). Under this framework, chemicals are scheduled according to their environmental risk, with Schedules 6 and 7 representing the highest concern. Chemicals that are prohibited or require specific risk management measures under these instruments are either excluded from use or managed in strict accordance with regulatory requirements.
			This approach ensures that environmental risks associated with chemical discharges are reduced to As Low As Reasonably Practicable (ALARP) and remain compliant with applicable Commonwealth legislation. Consideration is given to the schedule to which each chemical has been assigned under IChEMS, and all associated requirements are adhered to across the chemical lifecycle, including manufacturing, import/export, use, storage, and disposal, within Australia.
			Following the chemical management process (Section 10.4.6) together with compliance with the ICEMR Act and the Register Instrument, minimises the impact of chemicals used and discharged to ALARP levels.
				7.21	Chemicals that are planned for discharge to sea meet the following criteria:
					• are substitution warning free and rated Gold, Silver, D, or E through the Offshore Chemical Notification Scheme (OCNS), or are considered to Pose Little or No Risk to the Environment (PLONOR) (listed by the Oslo and Paris Convention for the Protection of the Marine Environment of the North-east Atlantic [OSPAR] Commission), or have a complete ALARP assessment.
					• are screened against the IChEMS register with:
					  ○ no use, importation or discharge of chemicals listed in Schedule 7 unless exempted under Commonwealth Legislation
					  ○ a complete ALARP assessment for chemicals listed in Schedule 6
						Chemical management assessment process forms outlined in the Shell Australia Chemical Management Process showing chemicals that are planned for discharge to sea are:
						• substitution warning free and are rated Gold, Silver, D, or E through the Offshore Chemical Notification Scheme (OCNS), or are considered to Pose Little or No Risk to the Environment (PLONOR) (listed by the Oslo and Paris Convention for the Protection of the Marine Environment of the North-east Atlantic [OSPAR] Commission), or have a complete ALARP assessment.
						• screened against the IChEMS register with:
						  ○ no use, importation or discharge of chemicals listed in Schedule 7 unless exempted under Commonwealth Legislation
						  ○ a complete ALARP assessment for chemicals listed in Schedule 6

ALARP Demonstration Statement						
Based on the impact assessment outcomes and control measures that have been adopted, Shell considers that implementing the control measures are appropriate to manage the potential impacts and risks of PW discharge associated with the activity. No additional, alternative, or improved controls were identified that could further reduce the impacts—beyond negligible environmental benefits if any—without disproportionate effort and cost. Therefore, the impacts and risks are considered to be reduced to ALARP.						

9.9.6 Acceptability of Impacts

Table 9-59: Acceptability of Impacts – PW Discharge

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Subcategory**			
Physical features, values and sensitivities	Water quality	No significant impacts to water quality. Impact not expected to result in a substantial change in water quality, which may adversely impact biodiversity, ecological integrity, social amenity or human health.	Yes	The PW discharge will result in a limited reduction in water quality within the immediate vicinity of the FLNG facility, which is located in a remote, dispersive open ocean location. The affected area will be dynamic and therefore changes in water quality temporary at different locations within the discharge plume. Water quality protective of most marine biota will be maintained beyond a very short distance from the discharge, with modelling showing that high water quality (i.e. protective of 99% of marine species) will be achieved within a horizontal distance of 700 m from the stern of Prelude. Effects are predicted to be restricted to the surface waters, not exceeding 16 m depth within a water column of ~240 m depth. No sensitive or highly productive environmental values are restricted or partially restricted to the area of potential effects and the biota that might encounter the discharge plume have widespread regional distributions. No recreational use occurs in the vicinity of the FLNG facility. Considering the nature and scale of potential changes in water quality, adverse impacts on biodiversity, ecological integrity, social amenity or human health are not expected. Slight impacts that are localised to the vicinity of the FLNG vessel are therefore considered acceptable.

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Subcategory**			
	Sediment	No significant impacts to sediment quality. Impact not expected to result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.	Yes	Produced water discharges may result in changes in sediment quality in the vicinity of discharge locations. However, accumulation of persistent organic chemicals, heavy metals, or other potentially harmful chemicals in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected is not anticipated due to the high level of dilution and dispersion in the open ocean environment. This level of impact is considered acceptable.
Natural features, values and sensitivities	Marine bioregions	No significant impacts to benthic habitats and communities. No significant adverse effect on demersal or pelagic communities, populations, habitats or spatial distribution of a species. No substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution.	Yes	No sensitive or highly productive environmental values are restricted or partially restricted to the area of potential affects and the biota that might encounter the discharge plume have widespread regional distributions. No impacts to benthic communities or demersal species expected due to water depths at FLNG location and buoyancy of the PW plume. Modelling and field monitoring studies indicate that potential impacts of PW discharge will be restricted to near-surface waters localised around the FLNG facility which is located in open offshore waters, typical of the bioregion. Given the dispersion and dilution predicted following discharge, mobile species are unlikely to be exposed to sufficient concentrations of PW for sufficient durations to cause significant

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	Subcategory			
		No known or potential pest species become established in the Commonwealth Marine Area.		impacts. Localised scale (< 700 m) of mixing zone represents a negligible proportion of regional planktonic assemblage distributions which are expected to rapidly recover from any adverse effects. Given the dynamic nature of the plume, transient presence of pelagic species and absence of important habitat or aggregation areas for pelagic species, potential effects to pelagic communities within a 700 m mixing zone will not have a significant adverse impact on the lifecycle, communities, populations, habitats or spatial distribution of any pelagic species.
	Threatened, migratory, marine and cetacean species	No mortality or injury of cetaceans. Management of aspects of the activity must align with conservation advice, recovery plans and threat abatement plans (Table 8-1). No significant impacts to EPBC Act listed threatened, migratory, marine or cetacean species.	Yes	Most EPBC Act listed species within the area predicted to be influenced by the PW discharge are air breathing vertebrates, which are unlikely to be directly affected as their skin is relatively impermeable and they breathe air. Hence, direct impacts are not considered credible. Non-air breathing species are not anticipated to be present in significant numbers nor be exposed to levels that may adversely impact on individuals and therefore there will be no significant impacts, mortality or injury. The activity aligns with conservation advice recovery plans and threat abatement plans as assessed in Table 9-60.

The assessment of impacts from PW discharge determined a Slight residual worst-case impact (Table 9-57). The acceptability of the potential impacts from PW discharge associated with the activity has been considered in the following context.

Principles of ESD

The potential impacts from PW discharges are consistent with the principles of ESD because:

- The aspect does not degrade the biological diversity or ecological integrity of the Commonwealth Marine Area and significant impacts to MNES are not anticipated to occur.
- The precautionary principle has been applied, and studies/reviews were undertaken (e.g. AIMS 2024) where knowledge gaps were identified. This knowledge was applied when evaluating environmental impacts.

Relevant Requirements

Managing the potential impacts from PW discharge is consistent with relevant requirements and other relevant requirements, including:

- ANZG water quality guidelines.
- policies, strategies, guidelines, conservation advice, and recovery plans for threatened species (Table 9-60).
- implementation of recognised industry standard practice, such as:
  - treatment of PW to ≤30 mg/L residual OIW. Treatment of PW to the defined limit exceeds the performance recommended by the IFC EHS guidelines for Offshore Oil and Gas Development (2015) where discharge to sea is allowed if oil and grease content does not exceed 42 mg/L daily maximum, i.e. mean level for any given day in the month assessed does not exceed 42 mg/L.
  - chemical selection process for process chemicals discharged to the environment.
  - adaptive monitoring and management program for PW discharges.

Matters of National Environmental Significance

Threatened and Migratory Species

The evaluation of PW discharge impacts indicates that significant impacts to threatened and migratory species will not credibly result from PW discharge during the activity. Table 9-60 demonstrates alignment between the activity and relevant management plans, recovery plans and conservation advice.

Commonwealth Marine Area

The PW discharge impacts from the activity are predicted to not exceed any of the significant impact criteria for the Commonwealth Marine Area listed in Table 8-1; as such, it is considered that the aspect does not pose a credible risk of significant impact to the Commonwealth marine environment.

***Table 9-60: Summary of* Alignment with Relevant MNES Considerations**

MNES	MNES Acceptability Considerations	Demonstration of Alignment
Threatened and Migratory Species	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1)	The application of the Shell Chemical Management Process and proposed management controls for PW discharges reduces the potential for impacts from toxic pollutants introduced into, and/or persisting in, the marine environment.
	Conservation Advice on *Balaenoptera borealis* (sei whale) (DoE 2015c)	
	Conservation Advice fin whale (*Balaenoptera physalus*) (TSSC 2015b)	
	Recovery plan for Marine Turtles in Australia 2017–2027 (CoA 2017b)	
	Conservation Advice on *Rhincodon typus* (whale shark) (DoE 2015e)	
	Conservation management plan for the blue whale: A recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999 2015-2025* (CoA 2015a).	
Commonwealth Marine Area	Significant impact guidelines for Commonwealth marine environment (Table 8-1)	Water quality impacts from PW discharges are expected to be highly localised. Impacts are not considered to be significant in the context of the significant impact criteria for the Commonwealth Marine Area given the nature and scale of the impacts and the characteristics of the local receiving environment (open offshore waters with regionally well represented soft and bare sandy sediments). The impact assessment indicates that any impacts associated with PW discharges are predicted to not have the potential to result in significant adverse impacts on marine ecosystem functioning/integrity, social amenity or human health. Shell has sought to reduce potential impacts by selecting and implementing the controls and EPSs listed in Section 9.9.5.

External Context

No objections or claims have been raised by relevant persons to date regarding PW discharges. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4.

Internal Context

Shell also considered the internal context, including Shell's environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented for the activity are consistent with the outcomes from consultation for the petroleum activity and Shell's internal requirements.

Acceptability Summary

The assessment of impacts and risks from PW discharges determined the residual impact ratings were Slight or lower (Table 9-57). The acceptability of the impacts from PW discharge associated with the activity has been considered in the context of:

- the established acceptability criteria
- ESD
- relevant requirements
- MNES
- external context (i.e. relevant persons claims or objections)
- internal context (i.e. Shell requirements).

Shell considers impacts from PW discharge associated with the activity to be ALARP and acceptable.

9.9.7 Environmental Performance Outcome

EPO #	EPO	Measurement Criteria
2.1	No injury or mortality of threatened, migratory or cetacean species associated with the Activities.	Reports of injury or mortality of EPBC listed threatened, migratory or cetacean species associated with the Activities sent to NOPSEMA and DCCEEW in accordance with requirements outlined in table 10-13.
7.1	No impact to water quality outside of the Mixing Zone Boundary from the discharge of produced water.	Monitoring and other supporting records of implementation of the AMMF.
7.2	Potential precipitation of toxicants from the PW discharge will not exceed toxicant default guideline values for sediment quality (ANZG) outside the impact zone for sediment, except where pre-operations baseline monitoring potentially shows exceedance already (ANZG).	Monitoring and other supporting records of implementation of the AMMF.

9.10 Other Liquid Discharges

9.10.1 Aspect Context

In addition to PW, operation of the Prelude FLNG facility will result in the discharge of a range of planned liquid waste streams to the marine environment. These include:

- Drainage and bilge effluent
- Food waste, greywater and sewage
- Cooling water (CW)
- Desalination brine, boiler blowdown and Mixed Bed Polisher (MBP) Effluent
- Use and release of chemicals in ad-hoc discharges.

Descriptions of the characteristics of each routine liquid discharge streams are summarised in Table 9-61 and further detailed specifically in Sections 9.10.1.1 to 9.10.1.5. Note that unplanned spills, e.g. of chemicals or hydrocarbons, are considered separately in Section 9.14, and discharges related to PW are described in Section 9.9.

Table 9-61: Types, Locations, Source Depth, Discharge Depth, Flow Rates and Orientations of the Planned and Routine Liquid Discharges from Prelude FLNG

Discharge Port Name	Discharge Type	Port or Starboard	Source Depth Below Sea Level (BSL) (m)	Typical Discharge Depth BSL (m)	Orientation	Maximum Estimated Flowrate (m^3/hr)
P47	Sewage	Port	N/A	11.5	Vertical	0.17–0.43 (Continuous)
						20 (Batch)
P50	Greywater	Port	N/A	11.5	Vertical	2.4–2.7
P50	Food waste	Port	N/A	11.5	Vertical	0.01–0.03
P6	Produced Water	Starboard	N/A	5	Horizontal outboard	50-165
P51	SW1 CW discharge	Port	Near Surface	12.1	Vertical	142
P60	SW1 CW discharge	Starboard	Near Surface	13	Vertical	142
P61	SW1 CW discharge	Starboard	Near Surface	12.6	Vertical	142
P53	SW2 CW discharge	Starboard	150	5.4	Horizontal to stern	14,000
P54	SW2 CW discharge	Starboard	150	5.4	Horizontal to stern	14,000
P63	SW2 CW discharge	Starboard	150	5.4	Horizontal to stern	14,000
P64	SW2 CW discharge	Starboard	150	5.4	Horizontal to stern	14,000
P48	SW3 CW discharge	Starboard	Near Surface	17.2	Vertical	4,028

Discharge Port Name	Discharge Type	Port or Starboard	Source Depth Below Sea Level (BSL) (m)	Typical Discharge Depth BSL (m)	Orientation	Maximum Estimated Flowrate (m^3/hr)
P49	SW3 CW discharge	Port	Near Surface	17.2	Vertical	4,028
P35	SW4 CW discharge	Port	Near Surface	6.2	Horizontal outboard	1,750
P36	SW4 CW discharge	Port	Near Surface	6.2	Horizontal outboard	1,750
P37	SW4 CW discharge	Port	Near Surface	6.4	Horizontal outboard	1,750
P59	Desalination brine	Starboard	N/A	12	Vertical	1,500
P30	Boiler blowdown	Starboard	N/A	18.5	Vertical	14–30
P38	MBP effluent	Port	N/A	12	Vertical	200
P62	Drainage effluent	Port	N/A	11.5	Vertical	15.8
P39	Bilge	Starboard	N/A	19	Vertical	18

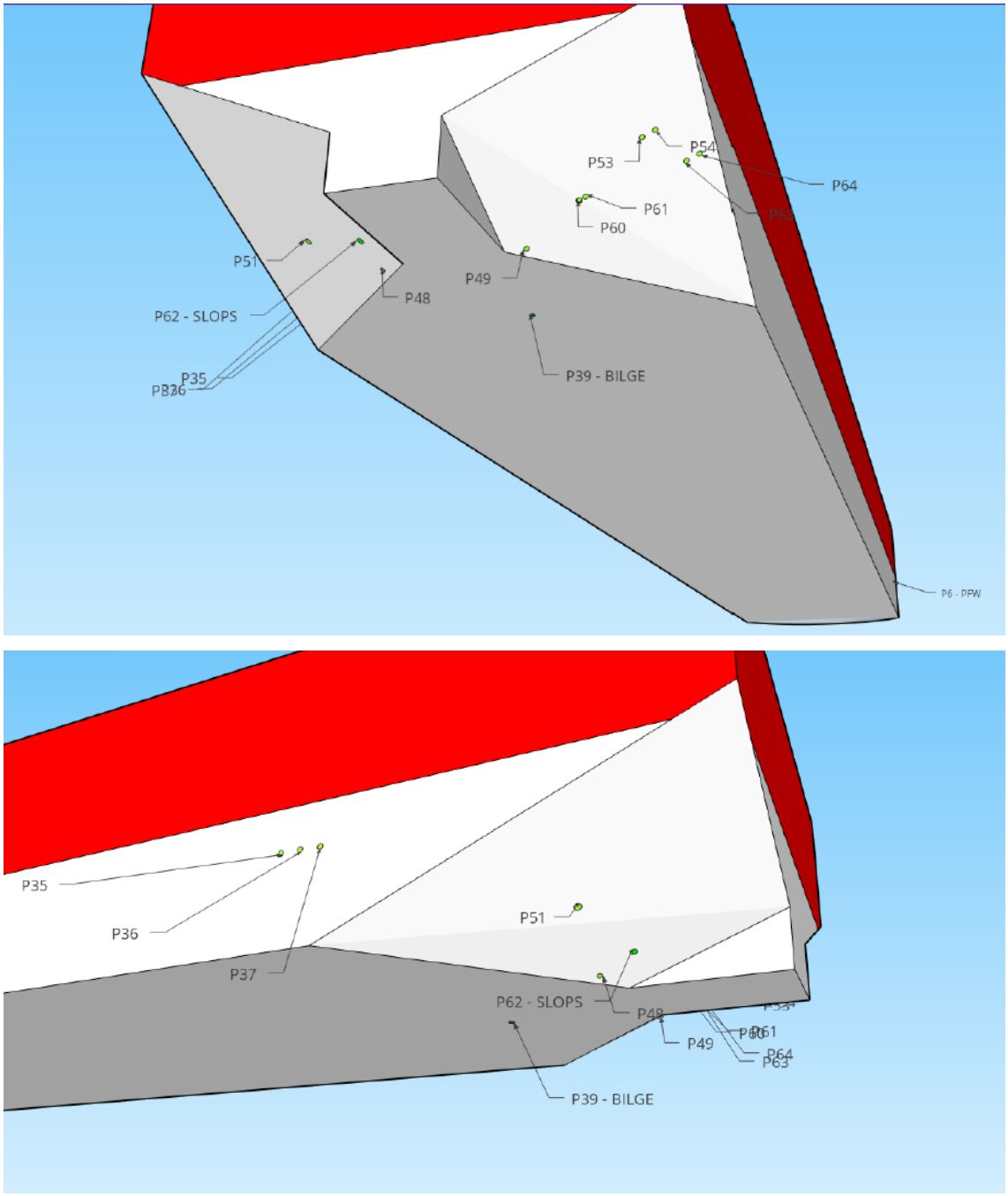


Figure 9-6: Locations of all routine planned liquid discharges on the Prelude FLNG. Numbers correspond with those in Table 9-61

9.10.1.1 Drainage (Slops) and Bilge Wastes

9.10.1.1.1 Marine Support Vessels

Deck drainage and bilge water from marine support vessels consists mainly of washdown water, seawater spray and rainwater but may also contain small quantities of oil, grease, metals, detergents (surfactants) and other residual chemicals. Discharge has the potential to create surface sheens and short-term, localised reduction in water quality if these enter the marine environment.

9.10.1.1.2 FLNG

The FLNG Open Hazardous Drainage System collects and disposes deck drainage (e.g. rain water), potentially oil contaminated streams (e.g. deluge water, accidental spills, and cleaning water during maintenance

activities) and continuous process drainage (e.g. automatic filter backwash, analyser conditioning systems). When there is deck drainage, the majority of inputs into the Open Hazardous Drainage system originates from continuous process drainage sources (~200 m^3 per week). All open hazardous drainage sources are directed to the Open Drain Tanks and then Slops Tanks where it is treated by gravity separation prior to discharge. The Slops Tanks can also act as a further separation mechanism for managing PW.

Similar to regular trading vessels, the Prelude FLNG facility has a machinery space and thrusters. Run-off from this area is collected in the Bilge System and treated prior to discharge using a unit designed to meet MARPOL limits.

Runoff from deck areas containing LNG, Mixed Refrigerant (MR) or LPG is not contained to ensure that cryogenic spills are not left in-situ to develop into flammable gas clouds on the facility. This is a design safety measure. In the unlikely event of a spill, the liquefied hydrocarbons would change into a gaseous phase rapidly with minimal effect on the marine environment. Therefore, in areas where potential cryogenic spills can occur, Entirely oil free streams of storm-water, sea spray and water generated from routine operations such as deck and equipment cleaning and fire drills are not collected and contained. To protect the environment from potential spills during maintenance of hydrocarbon containing equipment in cryogenic areas, spill equipment is stored onboard the facility to enable the establishment of temporary containment facilities.

The closed drain system will not discharge to the ocean, therefore, there are no risks or impacts associated with this system.

9.10.1.2 Food Waste, Sewage and Greywater

9.10.1.2.1 Vessels

Vessel activities within the Activity Area will likely require discharge of sewage, greywater and food waste. Typical discharge volumes per vessel type are provided in Table 9-62. These volumes are indicative only and are provided for the purposes of the corresponding impact assessment and may vary.

9.10.1.2.2 FLNG Facility

The sewage system on the FLNG facility collects black water, some greywater and sweat drains from the following prior to discharge:

- Accommodation
- Hospital
- Toilets in the aft machinery space.

The pumps and screens within the vacuum toilet and sewage collection system effectively comminute sewage particles. There is a sewage holding tank which was designed to hold sewage if not appropriate to discharge overboard.

The grey-water system processes the effluent stream from sinks, washbasins, showers, laundry and sweat drains. Drains from the galley sinks are routed to the grey-water system. Greywater quantity is greater than black water and can be managed separately if required. Greywater can be discharged directly overboard or overboard via the greywater tank.

The food waste system includes a macerator, which treats putrescible wastes prior to discharge to the ocean.

The expected production and release rates of sewage, greywater and food waste for the FLNG and typical vessels are shown in Table 9-62. These estimates are based on the anticipated upper bound, assuming peak manning, with the total volumes estimated also assuming all listed vessels are discharging in the Activity Area at the same time, which is highly unlikely.

Table 9-62: Upper bound estimates of sewage, greywater and food waste volumes and associated calculated nutrient input estimations into the marine environment

Vessel/Facility	Typical Max POB	Estimated Sewage volume (m^3/day)[1]	Estimated Greywater Volume (m^3/day)[2]	Estimated Food Volume (kg/day)[3]	Estimated Total Nitrogen (TN) Load (kg/day)[4]	Estimated Total Phosphorus (TP) Load (kg/day)[5]
FLNG	340	10.2	57.8	340	Sewage: 1.02 Greywater: 1.52 Food waste: 8.16 Total: 10.70	Sewage: 0.09 Greywater: 0.58 Food waste: 1.36 Total: 2.03
Supply Vessel	68	2.0	11.6	68	Sewage: 0.20 Greywater: 0.30 Food waste: 1.63 Total: 2.14	Sewage: 0.02 Greywater: 0.12 Food waste: 0.27 Total: 0.41
Infield Support Vessel	10	0.3	1.7	10	Sewage: 0.03 Greywater: 0.04 Food waste: 0.24 Total: 0.31	Sewage: 0.003 Greywater: 0.02 Food waste: 0.04 Total: 0.06
Installation Vessel	120	3.6	20.4	120	Sewage: 0.36 Greywater: 0.54 Food waste: 2.88 Total: 3.78	Sewage: 0.03 Greywater: 0.21 Food waste: 0.48 Total: 0.72
Accommodation Vessel (e.g. Major Maintenance Campaign)	650	19.5	110.5	650	Sewage: 1.95 Greywater: 2.91 Food waste: 15.6 Total: 20.46	Sewage: 0.17 Greywater: 1.12 Food waste: 2.6 Total: 3.88
Total Upper Bound (Rounded)					**37**	**7**

1.Calculated based on 0.03 m^3 per person/per day

2. Calculated based on 0.17 m^3 per person/per day (USEPA 2011)

3. Calculated based on 1 kg per person/per day

4. Conservatively assumes no consumption via vessel treatment systems. Calculated based on sewage discharge of 100 mg/L TN for sewage (Washington State Department of Health 2005), 26.3 mg/L for greywater (USEPA 2011) and 2.4% TN for food waste (Polglaze 2003).

5. Conservatively assumes no consumption via vessel treatment systems. Calculated based on sewage discharge of 8.6 mg/L TP for sewage (State of Idaho Department of Environmental Quality 2012), 10.1 mg/L for greywater (USEPA 2011) and 0.4% TP for food waste (Polglaze 2003).

9.10.1.3 Cooling Water

9.10.1.3.1 Vessels

Based on relatively low predicted volumes of CW discharged from vessels coupled with expected rapid dilution and dispersion, these discharges are not considered to present credible impacts to receptors and are not described further.

9.10.1.3.2 FLNG Facility

Seawater provides cooling to the production processes and essential equipment through once-through heat exchangers (most of them via an intermediate closed water loop). Seawater is then discharged to the ocean at an average of 8–12°C above the intake temperature (depending on season and the depth it is drawn from).

The Prelude FLNG facility has 12 seawater discharge outlets which are situated below the water line towards the stern of the facility. They differ by flow rate and orientation as shown in Table 9-61 and Figure 9-6. The total throughput of seawater during normal operations is approximately 70,000 m^3/hr.

Cooling is required for the FLNG facility from a safety and technical integrity critical perspective as part of the hydrocarbon production process. Therefore, maintaining a system that is free of internal marine fouling is absolutely integral to the safe and efficient operation of the facility.

Chlorine in the form of sodium hypochlorite, produced through the ECU, is added to the CW to reduce the potential for marine growth within the pipework of the cooling water system. The entire system is designed for a fixed amount of seawater flowing into the ECU unit. Hypochlorite injection is controlled by varying the current sent to the ECU cells and the rate at which hypochlorite is dosed into the various systems. Based on operating experience, the free residual chlorine discharge limit was most recently revised to a timed average of 0.6 mg/l for each seawater loop as defined by EPS 8.9.

9.10.1.4 Desalination Brine and Mixed Bed Polisher Effluent

The production of freshwater from seawater in the seawater distillers on the FLNG facility results in a discharge of seawater with a slightly elevated salinity (approximately 10% higher than seawater). The volume of the discharge is dependent on the operational demand for fresh (potable) water. Standard demand for freshwater for the FLNG facility is approximately 70 m^3/hr, however this may be up to 120 m^3/hr during major maintenance activities or other campaigns, which require a greater number of people to be located at the facility for short periods of time. Chlorine scavenging, scale inhibiting and/or small volumes of other treatment chemicals may be present in the waste stream at low concentrations.

MBP effluent which is batch discharged approximately every two weeks, is characterised in Table 9-61 and location shown within Figure 9-6. The discharge is managed to pH 6-12 and is generated from the requirement to regenerate the mixed bed polishers to ensure their reliable operation.

The boiler blowdown discharges are associated with water within the boiler system that is discharged with flashed steam as is the case for many commercial vessels that utilise marine boiler systems. The boiler blowdown discharge is a continuous discharge of approximately 2 m^3/hr per boiler. On irregular occasions, when deposits in the boiler drums have to be removed, approximately 30 m^3 per hour may be discharged for short durations. The discharge is characterised in Table 9-61 and location shown within Figure 9-6. The discharge is managed to a pH between pH 9-12 and also contains residual chemical additives which are used to prevent corrosion and scale build-up within the boilers to maintain safe, energy efficient and functional integrity.

9.10.1.5 Use and Discharge of Chemicals

Chemical usage is required for various routine and non-routine process and non-process applications and as such, chemicals may be present in wastewater streams which are discharged to the ocean.

Chemicals are utilised on the Prelude FLNG facility, marine support vessels and associated subsea facilities for a variety of purposes and can be divided into four broad categories, as described below.

9.10.1.5.1 Operational Process Chemicals

An operational process chemical is the active chemical added to a process or static system, which provides functionality when injected in produced fluid, utility system streams or for treatment. These chemical types may be present in continuous or batch discharge streams into the ocean:

- Hydrate inhibitor
- Oxygen scavenger
- Scale inhibitor
- Biocide
- Antifoam
- Demulsifier
- Reverse Demulsifier

- Hypochlorite
- Boiler Water Treatment
- Water Clarifier
- Acids e.g. hydrochloric, citric, sulphamic
- Paraffin Inhibitor/Pour Point Depressant
- Hydraulic control fluid (subsea) - Subsea control fluids are used to open or close wellhead/subsea valves resulting in small volumes of subsea control fluids being discharged each time a valve is activated.
- Corrosion inhibitor to protect the Crux export pipeline, and TEG from the Crux production process will be imported to Prelude through the hydrocarbon export stream.

9.10.1.5.2 Facility Maintenance/Non-Process Chemicals

Facility maintenance chemicals include chemicals which are required for general maintenance activities on the FLNG facility, marine support vessels and respective equipment. These may include paints, degreasers, greases, fire-fighting foam, lubricants and domestic cleaning products. They may also include chemicals required for speciality tasks, such as laboratory testing and analysis. These non-process chemicals generally present negligible risk to the environment as they are either not usually discharged as a result of their use (e.g. paint) or are used intermittently and/or are typically only ever discharged in small volumes and/or low concentrations (e.g. domestic cleaning products, washdown cleaners, closed cooling water change out or fire-fighting foam during testing).

9.10.1.5.3 Subsea Operation, IMR and Intervention Activity Chemical Discharges

The majority of the maintenance and intervention activities are non-intrusive visual inspections undertaken via ROV as the facilities are designed for a minimum of 25 years field life with minimal intervention. However, in the event that certain subsea equipment needs maintenance, repair, replacement or well intervention due to failure or damage for example, the estimated associated discharge types and volumes are provided in Table 9-63.

Table 9-63: Estimated Chemical Discharge Types and Typical Volumes during Subsea Operation, IMR and Intervention Activities

Discharge Type	Estimated Discharge Per Event
Control module replacement, hotstab activities	Approximately <10L of control fluid/associated chemical
Subsea equipment replacements (i.e. choke valve, flow module, flowline connector)	Approximately <1 m^3 of MEG with residual produced hydrocarbon per item
Flexible riser connector replacement	Approximately 20 m^3 of MEG with residual produced hydrocarbon per connector
Riser replacement	Approximately 40 m^3 of MEG with residual produced hydrocarbon per riser
Light well intervention (Refer to Section 6.10.5)	Approximately 3.2 m^3 MEG, residual produced hydrocarbon, freshwater and associated dosing chemicals discharged from the production trees and well intervention tooling.
Dye used for leak detection and environmental monitoring purposes	Approximately 5 - 50L per leak test or monitoring event
Cycling of subsea valves[1]	Approximately <11 L per actuation per valve of hydraulic fluid
ROV Operations	Approximately <0.1 m^3 of hydraulic fluid

Discharge Type	Estimated Discharge Per Event
Calcium and marine growth removal or pipe treatment	Approximately < 100 L of acid-water mix, typically citric or sulphamic acid, per inspection point/activity. Approximately 5 m^3 for SCM replacement. Staurolite mineral for sand/abrasive blasting activities.
Grouting, grout bag installation and grout line flushing	Approximately < 0.2 m^3 per discharge

1 – Note cycling of valves and associated discharges is also a routine ongoing activity

Table 9-63 reflects a number of other planned liquid discharges that may occur during the project life, including hydraulic fluids from ROVs or other underwater equipment, downline flushing (e.g. grout and/or hotstab lines during IMR campaigns), lubrication fluids from planned maintenance of the subsea system, fluids from IMR activities such as coatings repair, closed cooling water replacements, hydrotest fluids and others from time to time. These discharges are expected to be for short durations, infrequent and/or relatively minor in nature and scale and any potential impacts are expected to be confined to within the area influenced by the larger planned discharges described in this section and are unlikely to result in impacts to the environment that are not already assessed within this EP.

It is impractical to forecast exact types and volumes of all required liquid discharges for potential future activities throughout the facility lifetime and therefore Table 9-63 is indicative only for the purposes of this impact assessment.

9.10.2 Liquid Discharges Monitoring, Modelling and Investigations

Monitoring and management of the Prelude liquid discharges over the period 2021–2025 (i.e. since the last revision of this EP was accepted by NOPSEMA) was undertaken in accordance with the 2020 AMMF requirements as described in Section 10.4 of the accepted EP (Shell 2021). The key components are summarised in Table 9-64, with a summary of outcomes provided in Sections 9.10.2.1 to 9.10.2.3.

Table 9-64: 2020 AMMF Requirements for CW

Monitoring Component	Summary
Topsides monitoring	Ongoing monitoring of flow rates and select constituent content in certain discharges, including • OIW in slops, drainage and bilge discharge • chlorine in CW discharge
Mixed Discharges WET test	Once off, after initial field water sampling survey and coinciding with next scheduled PW WET testing To determine if the toxicity of potential comingled discharges are greater than the PW discharge alone and if so, to understand: • if it confirms the model is predicted to still be conservative • if comingled discharges have significant additive or synergistic impacts • the likely major contributors to overall toxicity in comingled discharges
Field water quality sampling	5-yearly

9.10.2.1 Discharges Comingling Study

Although PW is discharged near the bow of the Prelude facility, it is frequently transported by prevailing currents toward the stern where it can comingle with the chlorinated CW discharge, potentially forming more toxic oxidised or chlorinated products. Therefore, a study to determine whether comingling of PW with (chlorinated) CW following discharge would increase plume toxicity was undertaken. The study included chemical characterisation, Microtox assays and DTA using 2 marine species. Key outcomes include:

- The concentration of chlorine produced oxidants (CPOs) in the CW rapidly decayed on comingling with PW

- The Prelude CW samples exhibited no toxicity in the Microtox assays and comingling had no effect on PW toxicity
- DTA results for comingled discharges showed no significant change in the dilutions required to achieve 99% SPL for PW

9.10.2.2 Modelling Studies

9.10.2.2.1 Dispersion Modelling

To calculate the fields of effect of liquid discharges from the Prelude FLNG, taking account of any comingling or cross-contamination potential, Shell commissioned hydrodynamic three-dimensional numerical dispersion modelling. The dispersion study (RPS 2019b) considered processes occurring at two different scales: “near-field” processes generated by the discharge and “far-field” processes generated by the ambient currents and ocean turbulence. Near field dispersion rates for each of the discharge streams were simulated independently, using CORMIX, based on the discharge orientation and geometry (Table 9-61), under both weak and strong current conditions. To assess for further dilution of constituents over wider distances (far-field), simulations for transport and dispersive mixing for all discharges occurring together were completed using the 3-dimensional Delft3D model. Consideration of the dispersion of discharges, including the potential for comingling and cross-contamination, took account of the orientation of the current to the hull, the alignment of the discharges with the current, the behaviour of each discharge (including tendency to rise or sink) and the distance separating discharge ports (vertically and horizontally) from other ports and the down-current extent of the ship.

Key outcomes of the modelling include:

- desalination discharge would be diluted ~900-fold within <100 m of the discharge, achieving no impact concentrations within ~80 m of the FLNG stern
- bilge and slops discharges would be diluted >2000-fold within ~140 m of the FLNG facility
- dilution of boiler blowdown discharge would be >2360-fold within ~107 m of the discharge
- the 12 discharge points of the CW system (Table 9-61) are located sufficiently close so that interaction is likely between a number of the CW plumes much of the time (Figure 9-7 and Figure 9-8). The collective field of effect for chlorine contributed by all CW discharges occurring simultaneously was calculated at ~180 m from the FLNG hull for the worst-case combination of the highest potential discharge concentration (0.6 mg/L) and a no-effect threshold concentration of 0.003 mg/L, under the 95th percentile current speed, assuming relatively calm sea conditions. The field of effect should be shorter for lower current speeds and more energetic sea conditions. Proportionally shorter fields of effect should result from discharge of free chlorine at concentrations lower than 0.6 mg/L.

Figure 9-7: View of cooling water discharge ports P53, P54 (inboard pair), P63 and P64 (outboard pair) that discharge rearwards on the starboard side

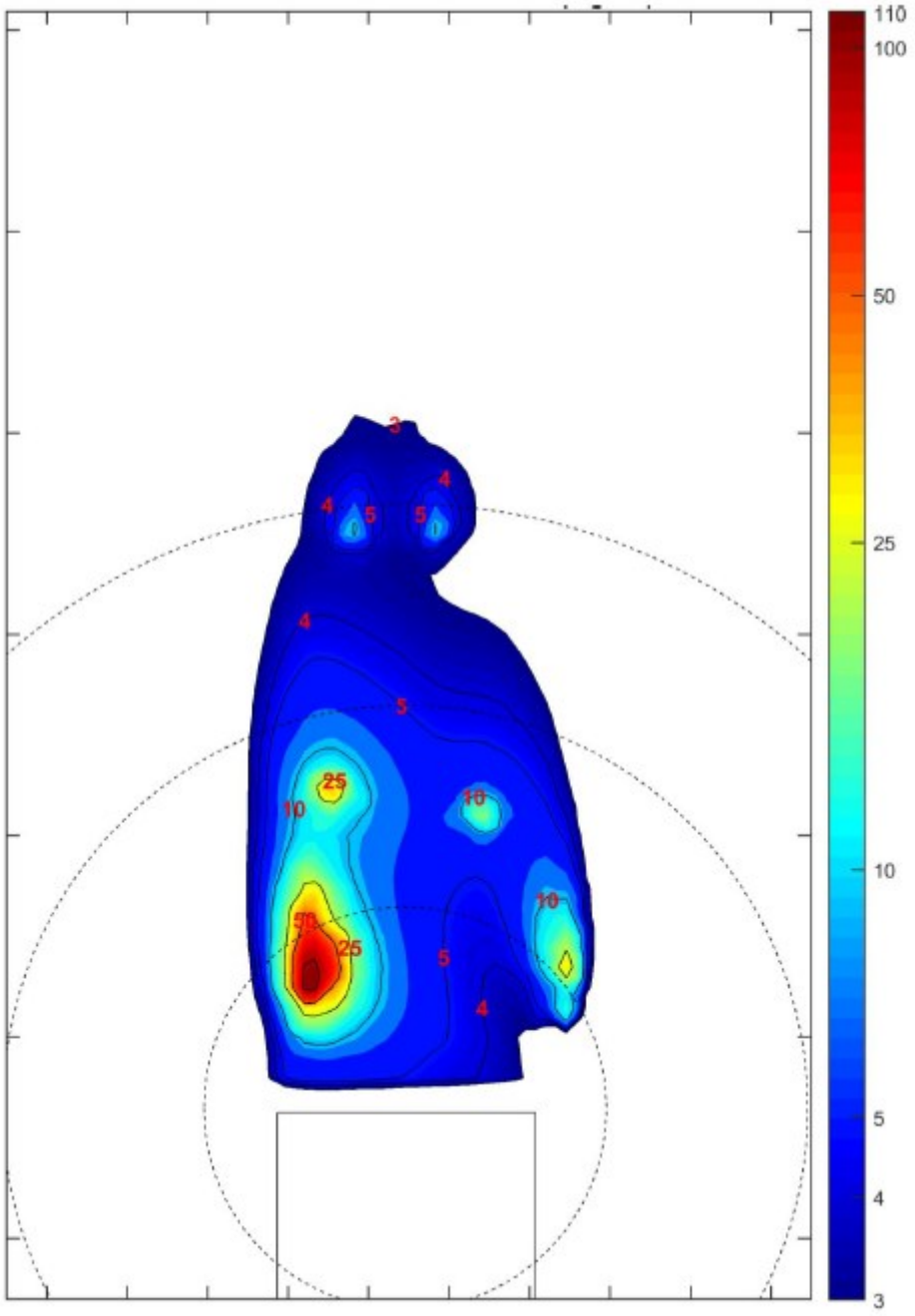


Figure 9-8: Calculation for the combined distribution of free chlorine in the far-field accounting for all water discharges under the 95th percentile current. Range rings mark 50 m increments from the stern. The field of effect is illustrated for concentrations >3 ppb free chlorine. The key shows ppb. The gap between the stern and chlorine distributions represents the near-field zone.

9.10.2.2.2 Temperature Modelling

The discharge of CW near the ocean surface results in a change of surface temperature of the waters surrounding the FLNG facility, which may cause alteration of the physiological processes (especially enzyme-mediated processes) of exposed biota. To examine the extent of potential effects, two separate modelling studies have been undertaken to assess the behaviour of CW plumes from a temperature dissipation perspective. These studies are summarised below:

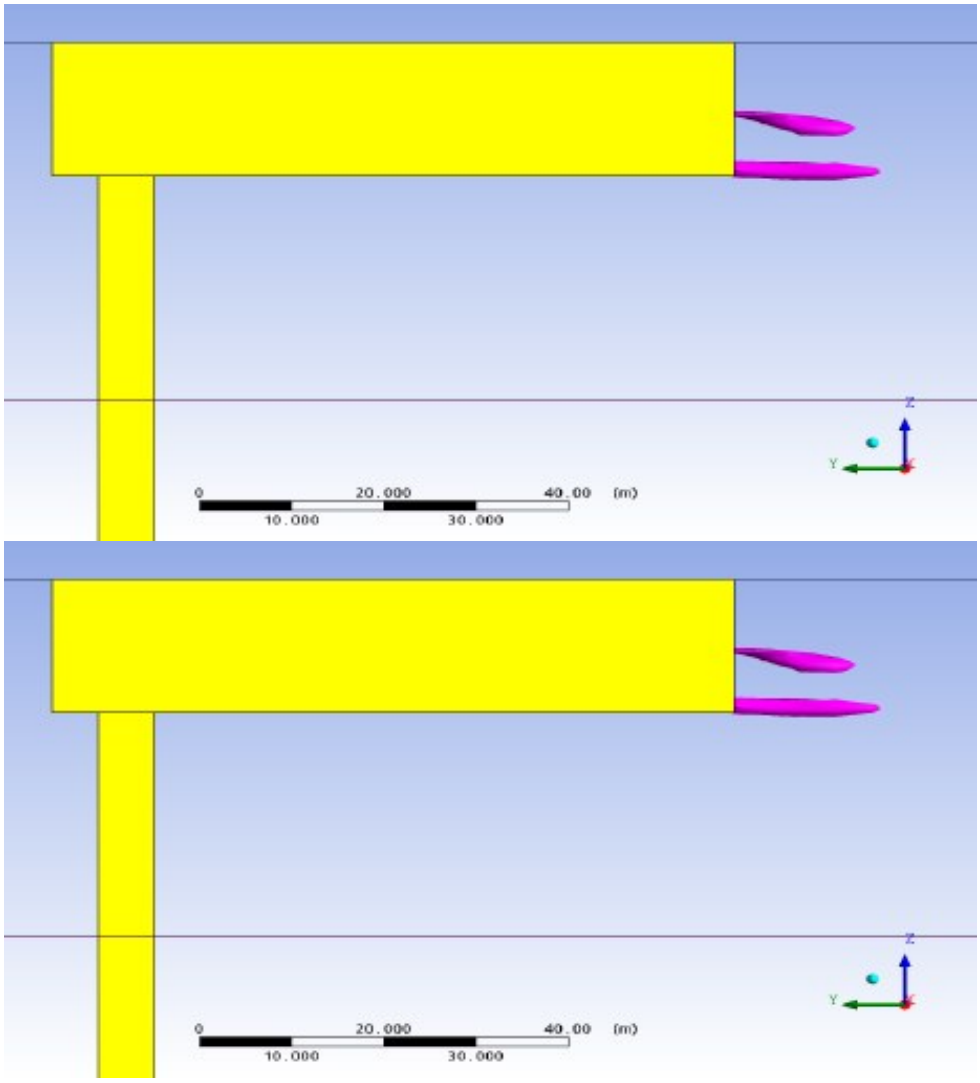


Figure 9-9: Excess temperature larger than 3°C (summer scenario, large flow velocity directed from the outlets)

Shell (2019) undertook sensitivity testing using the USEPA supported CORMIX model to assess the worst-case scenario of the CW plume behaviour from the largest single port discharge rate (SW2 – 14,000 m^3) releasing water at the maximum piping temperature design integrity envelope upper-bound of 50°C. Although this scenario is highly unlikely, it has been included in this impact assessment to test the maximum design envelope to gain confidence around the extent of the theoretically feasible temperature impacts as an absolute worst case. The model was applied to determine the dilution profiles, with focus on the near-field effects, and location of excess temperature under different scenarios considering low and high tidal flow velocities, winter and summer water temperatures, and low and high wind velocities representative of the expected environmental ranges. Model predictions were compared to the IFC (2015) guidelines for water temperature which suggest discharges should not result in a temperature differential of greater than 3°C relative to the ambient temperature of receiving waters at the edge of the defined discharge mixing zone, or a default distance of 100 m.

The worst-case scenario was predicted to occur in winter for downstream-oriented discharges under low tidal flow velocities, due to the higher modelled temperature difference between discharge and ambient seawater temperatures combined with limited strong vertical mixing due to dominant buoyancy forces (Figure 9-10). This scenario is highly unlikely given the CW pipes typically discharge water at temperatures of between 8–12°C above the intake temperature depending on season and the depth it is drawn from (vs the 25°C assumed difference in the model) and the FLNG facility weathervanes around the turret, exposing the discharge to varying current flows. The IFC guideline standard was met at ~100 m from the discharge

point for the worst-case scenario, while for all the remaining scenarios the standard was met at distances between ~4 m upstream and ~39 m downstream of the discharge point.

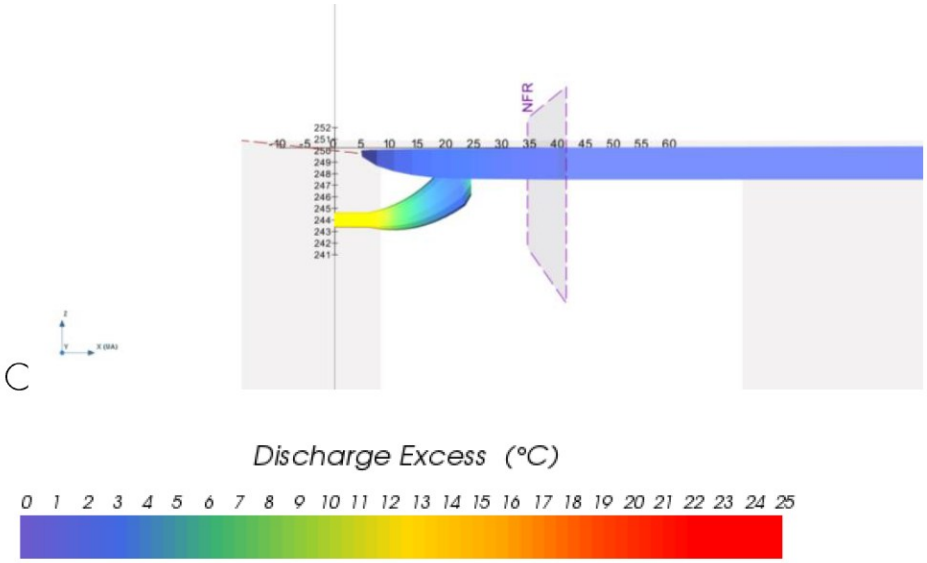


Figure 9-10: CORMIX visualisation plot for worst-case winter scenario (low wind, low flow, downstream). The Near-Field Region (NFR) is indicated in purple.

9.10.2.3 Field Water Quality Monitoring

In accordance with the AMMF, a field water quality monitoring study was undertaken within the five-year currency period of the previous revision of this EP. The field study included on-board sampling of CW and in-situ sampling of seawater near the CW discharge ports and at varying distances downstream within the CW plume. Chemical characterisation of the samples was undertaken to provide an understanding of post-discharge dispersion rates as well as potential for comingling with the PW discharge. To assess the potential toxicity of the analytes detected in seawater samples, multi-substance Potentially Affected Fraction (msPAF) was calculated for each seawater sample based on their measured chemical composition using the approach described in Brinkman et al. (2025c). Key outcomes of the study were:

- physical chemistry and dissolved metal concentrations in pre-discharge (on-board) CW samples reflected ambient levels in seawater. Free chlorine levels ranged from 0.08 to 0.12 mg/L
- nearly all analytes in the CW plume (seawater) samples were below analytical LOR or equivalent to reference seawater concentrations. Total chlorine and chlorine byproducts were slightly elevated near the CW discharge point but not at downstream sites. Toxicity modelling showed minimal contribution from chlorine (msPAFchem for CPOs <0.0001) and median msPAFchem values for both near discharge and downstream samples were indicative of achieving 99% species protection
- there was no evidence of significant comingling between PW and CW streams, with plumes observed to travel parallel to one another during sampling. The fields of effect from discharges described in the EP (Shell 2021) are likely conservative
- the results show little to no risk to marine waters from the CW discharge outside the defined (Shell 2021) mixing zones.

9.10.3 Description and Evaluation of Impacts

Table 9-65 indicates the environmental features and values and sensitivities that have been identified to be potentially affected by the liquid discharges that may occur during the activities covered by this EP, with further evaluation of the impacts and/or risks to each potentially affected receptor category (including cumulative

impacts) provided in Sections 9.10.3.1 to 9.10.3.4. Features or values and sensitivities which could not be credibly affected by liquid discharges are not discussed further.

Liquid discharges to the marine environment may result in a localised decline in water quality, which may expose sensitive biological receptors in the area affected to physiochemical changes and/or contaminants at concentrations that may cause acute or chronic effects. The magnitude and sensitivity of any impacts on sensitive receptors will vary depending on multiple factors, including discharge composition, plume dilution/dispersion, bioavailability, duration of exposure and marine species physiology and behaviour.

Table 9-65: Liquid Discharges Receptor Impact Screening Summary

	Protected Areas			Features															Values and Sensitivities																							
				Physical		Natural				Socioeconomic							Heritage and Cultural			Physical				Natural							Socioeconomic							Heritage and Cultural		
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect									×													×									×										

Legend:		
		Potentially affected
	×	Predicted impact

9.10.3.1 Natural Features

9.10.3.1.1 Timor Province Bioregion

Benthic Communities

Dispersion modelling for the CW discharge indicates that the resulting plume where potential impacts to marine biota may occur is limited to the surface waters (~20 m depth) and to within close proximity (~200 m) of the discharge location (RPS 2019b). Field validation studies (Section 9.10.2.3) show that these predictions were conservative (AIMS 2025). The majority of other liquid discharges from the Prelude facility involve relatively small volumes at or near the sea surface, and are expected to be rapidly dispersed and diluted upon release into the open ocean environment (Section 9.10.2.2.1). Given the water depths (i.e. ~240 m) at the facility location, benthic communities are not anticipated to be adversely affected.

Operational discharges associated with subsea infrastructure involve very small volumes and IMR activities are typically non-intrusive visual inspections undertaken via ROV as the facilities are designed for a minimum 25 years field life with minimal intervention. However, in the event that certain subsea equipment needs maintenance, repair, replacement or intervention, relatively small volumes of chemicals may be released (Table 9-63). The largest volume (~40 m^3) release would involve MEG, which is highly soluble, would be rapidly dispersed, and is readily biodegradable and non-bioaccumulative (Centre for Environment, Fisheries and Aquaculture Science 2019).

Therefore, the residual impact consequence of other discharges on benthic communities is assessed as no impact (Magnitude: 0, Sensitivity: L).

Pelagic Communities

Pelagic communities potentially affected by liquid discharges include plankton and pelagic marine fauna. EPBC Act listed species of marine fauna (including fish, sharks and rays) are discussed in Section 9.10.3.3.1.

The mobile nature of pelagic fauna combined with the intermittent nature of most liquid discharges and the relatively localised extent of impacts on water quality (Section 9.10.3.2.1) restricts the likely duration and concentrations of exposure to contaminants that may have adverse effects. Impacts to pelagic fish are expected to be limited to avoidance of any localised area of decreased water quality. Discharge of sewage and putrescible wastes may create a localised and temporary increase in food sources for scavenging marine fauna, such as fish and seabirds. Given the absence of aggregation areas that may be exposed to liquid discharges, and the localised extent of potential effects relative to the widespread distributions of the pelagic fauna present within the Activity Area, no or negligible impacts are expected.

Nutrients in sewage, greywater, and putrescible waste, such as phosphorus and nitrogen, can stimulate increased growth in phytoplankton. Conversely, the chemical and/or other potential contaminants in some discharges may have toxic effects on plankton. Chlorinated CW is the highest volume discharge from the FLNG facility. The effect of chlorine on marine organisms is well known, given its widespread use as a biocide (Abarnou and Miossec 1992). Although chlorine is rapidly oxidised in seawater, some chlorine produced oxidants (CPOs) can also be toxic to marine biota (ANZG 2025). However, the open marine waters where Prelude is moored are influenced by regional wind and large-scale ocean current patterns, typically resulting in the rapid mixing of surface and near-surface waters where most discharges (including CW) will occur. Because of this highly dispersive environment, potential effects are limited to the immediate vicinity of the discharge. Modelling of CW predicts guideline values for both temperature and chlorine, including 99% SPL for CPOs, will be met within short distances downstream of the discharge ports (Section 9.10.2.2). Field sampling of the CW discharge indicated low toxicity (Section 9.10.2.1) and confirmed rapid dispersion, with chlorine and chlorine byproduct concentrations comparable to reference sites beyond the discharge location (AIMS 2025). Although the Timor Sea is characterised as a low nutrient environment (Brewer et al. 2007), natural seasonal upwelling can result in localised and sporadic high phytoplankton productivity along/offshore of the Sahul Shelf. Planktonic communities are regionally distributed and characterised by relatively rapid turnover rates of short-lived biota. Consequently, impacts from liquid discharges are expected to be limited to short-term, localised changes in planktonic communities in the immediate vicinity of the discharge.

The impact consequence to pelagic communities associated with liquid discharges is considered Slight (Magnitude: −1, Sensitivity: L).

9.10.3.2 Physical Values and Sensitivities

9.10.3.2.1 Water Quality

Drainage (Slops) and Bilge Effluent

Open drainage (slops) and bilge waste discharges are intermittent discharges which can result in water quality changes immediately surrounding the discharge point, with the spatial extent of changes to water quality remaining very localised. It is recognised that there may be various minor quantities of metal and chemical constituents that may not be captured as a part of the oil treatment systems associated with the open drains and bilge systems (described in Section 6.9.13) and onboard support vessels. This may result in the discharge of minor quantities of diluted toxicants into the ocean resulting in localised and temporary reductions in water quality, with the spatial extent of effects depending on the volume and characteristics of the discharge(s).

Overall, the residual impact consequence to water quality from the discharge of open drainage and bilge effluent is considered Slight (Magnitude: –1, Sensitivity: L).

Food Waste, Sewage and Greywater

Discharge of sewage, greywater and food waste into the marine environment may impact on water quality, including eutrophication, increased turbidity, increased pathogens (bacteria, viral agents and/or parasites), and increased biological oxygen demand (BOD). These discharges can contain a variety of substances typically at very low concentrations, including oil/grease, some organic compounds, detergents, metals, suspended solids, chemicals, personal hygiene products and pathogens.

In 2008, Woodside conducted monitoring of 10 m^3 of sewage discharged at distances of 50 m, 100 m and 200 m downstream of a platform and at five different water depths over a period of 24 hrs (Woodside 2008). This monitoring confirmed that discharges of macerated sewage were rapidly diluted or nutrients rapidly metabolised. No elevations in water quality monitoring parameters (e.g. total nitrogen, total phosphorous and selected metals) were recorded above background levels at any station. This Woodside monitoring scenario is conservative when compared to the Prelude case because Prelude's movement around the turret and the sewage discharge point being near the back of the hull (more turbulent) will lead to more mixing of the sewage discharged.

The Woodside (2008) study demonstrated that a 10 m^3 sewage discharge over 24 hrs from a stationary source in shallow water, reduced to approximately 1% of its original concentration within 50 m of the discharge location. In addition to this, monitoring at distances 50, 100 and 200 m downstream of the platform and at five different water depths confirmed that discharges were rapidly diluted or nutrients rapidly metabolised 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. As sewage discharge from the FLNG facility is ~10 m^3/day, this study provides confidence to the residual impact ranking given the deep water and highly dispersive offshore environment of the Activity Area.

Given the volume and properties of the discharged effluent, which are typically highly biodegradable, low toxicity and low persistence, the rapid dilution in the open ocean environment, localised impact area, and the offshore location of the Activity Area, the residual impact consequence to water quality is assessed as Slight (Magnitude: –1, Sensitivity: L).

Cooling Water

Seawater discharged from the Prelude FLNG facility after onboard use for cooling will have a slightly elevated temperature and contain residual treatment (chlorine) concentrations.

For the purposes of impact assessment, discharge concentrations of 0.6 mg/L free chlorine and temperatures up to the maximum design level were assumed as the worst-case scenario. The modelling of the CW discharges (Section 9.10.2.2) considered processes occurring at near-field and far-field scales and focused on the fate of free chlorine within the streams and temperature dissipation under worst-case conditions.

The effects of chlorine and chlorine breakdown products in CW discharges have been the subject of many studies, generally through toxicity testing. Chlorine is a strong oxidant and following discharge and dilution, the residual (free) chlorine quickly reacts with inorganic constituents such as sodium, iron (II), nitrite and sulphide to produce chlorides (such as NaCl). There are currently no adopted ANZG (2018) marine water DGVs for chlorine. ANZECC/ARMCANZ (2000) provided a low reliability value (LRV) of 0.003 mg/L and this was applied

in the CW modelling assessment (Section 9.10.2.2.1). Recently, ANZG (2025) proposed draft chlorine (CPO) DGVs using toxicity data on 29 species from 5 taxonomic groups in a species sensitivity distribution (SSD) to derive very high reliability marine guideline values protective of 99%, 95%, 90% and 80% of species. The resulting 99% SPL of 0.0043 mg/L was slightly higher than the LRV, with a chlorine concentration of 0.010 mg/L reported to be protective of 95% of species. The dispersion study for Prelude discharges (RPS 2019b) indicated that, assuming all CW outlets discharging simultaneously and a worst-case free chlorine level in the discharges (i.e. 0.6 mg/L), the dilution level required for the CW discharge plume to reach a concentration of 0.003 mg/L would be achieved at approximately 180 m from the FLNG hull under the 95th percentile current speed and relatively calm sea conditions. The field of effect for any lower current speeds and more energetic sea conditions should be even shorter due to faster dispersion rates and smaller displacement of the plume. Proportionally shorter fields of effect would result from discharge of free chlorine at lower concentrations. Field water quality monitoring undertaken during representative operational conditions (Section 9.10.2.3) confirms that the potential toxicity of the CW discharge rapidly dissipates and has limited potential to adversely affect seawater quality beyond close proximity of the discharge ports.

The discharge of CW near the ocean surface results in a change of temperature of the waters surrounding the FLNG facility, which may cause alteration of the physiological processes (especially enzyme-mediated processes) of exposed biota. These alterations may cause a variety of effects, ranging from behavioural responses (such as attraction or avoidance) to minor physiological stress or potential mortality for prolonged exposure if temperatures are sufficiently high. Modelling of the influence of the CW discharge on ambient water temperature (Section 9.10.2.2.2) shows that effects would be restricted to near-surface waters in close vicinity of the discharge location, and not exceed 3°C at distances beyond ~100 m under any conditions.

Given the high decay rate of free chlorine, rapid dilution/dispersion and temperature transference predicted for the CW discharge in the open offshore deepwater environment, the potential impact area is highly localised (<250 m from the FLNG) and the residual impact consequence to water quality associated with CW is assessed as Slight (Magnitude: –1, Sensitivity: L).

Desalination Brine, Boiler Blowdown and MBP Effluent

Desalination brine is estimated to be discharged at up to ~ 1,500 m^3/hr. Being of greater density than seawater, this will sink and disperse rapidly in the deep water and open oceanic currents. The largest increase of salinity experienced would be approximately 10% in the immediate vicinity of the discharge point.

There are minor amounts of anions, cations (mostly Na+ and Cl-) and residual chemicals associated with MBP effluent resulting from the MBP regeneration process. There will also be residual chemical additives within the boiler blowdown operational discharges. The potential differences in pH of MBP effluent neutralisation tank and boiler blowdown water (pH range estimated at 6-12) compared to background seawater (pH approximately 8.2) are predicted to resolve very rapidly within a very localised area due to the highly dilutive open offshore deepwater environment and very good natural buffering capacity of the ocean which will quickly bring the discharge back to ambient pH (ANZECC 2000).

The residual impact consequence for water quality as a result of brine, MBP effluent and boiler blowdown discharges is assessed as Slight (Magnitude: –1, Sensitivity: L).

Use and Discharge of Ad-Hoc Chemicals

The infrequent release of minor quantities of chemicals and production fluids due to planned ad-hoc discharge activities may result in a localised and temporary reduction in water quality around the discharge. Discharge of small volumes of these fluids are predicted to disperse and dilute rapidly with the spatial extent of any impacts likely to be limited to the water column, and very localised around the discharge point. Therefore, the residual impact consequence is assessed as Slight (Magnitude: –1, Sensitivity: L).

9.10.3.3 Natural Values and Sensitivities

9.10.3.3.1 Threatened, Migratory, Marine and Cetacean Species

Many of the EPBC Act listed species potentially exposed to activity discharges are air-breathing vertebrates, which are unlikely to be directly affected as their skin is relatively impermeable. Fish, including sharks and rays, are more susceptible to impacts from changes in water quality, particularly the potential toxicity of residual contaminants in discharges. However, there are no aggregation areas for any species of fish, sharks or rays

within areas credibly affected by Prelude liquid discharges and threatened or migratory species that may occur coincident with discharges are highly mobile and widely distributed.

The discharge of sewage and putrescible wastes will create a localised and temporary increase in particulates on or near the surface waters. This may act as a food source for scavenging marine fauna (e.g. fish and seabirds), whose numbers may temporarily increase locally as a result, and/or stimulate increased phytoplankton growth. This in turn could offer additional prey sources for predatory fish or cetacean species (e.g. dolphins) potentially altering local feeding behaviours. However, given the nature and scale of discharges and the absence of important habitats for these species in areas potentially affected, the extent of any effects on EPBC Act listed species are expected to be negligible.

The discharge of CW will create a localised and temporary increase in water temperature on or near the surface waters. Sea snakes, including the dusky sea snake, are aquatic ectotherms that have little capacity to thermoregulate. However, marine sea snakes can generally avoid high water temperatures for short periods of time by moving to deeper and cooler layers of water (Heatwole et al. 2012). Additionally, no habitat where sea snakes may occur has been identified within the Activity Area.

Overall, the residual impact consequence of liquid discharges on threatened, migratory, marine and cetacean species is considered Slight (Magnitude: −1, Sensitivity: M).

9.10.3.4 Cumulative Impacts

The Prelude FLNG routine planned liquid discharge types and rates are typical of most manned offshore facilities and the specific characteristics of each are summarised in Table 9-61. Design considerations applied to the location of individual discharge ports and intakes included potential to minimise interaction and recirculation. However, as the FLNG facility sits in an open offshore environment where current conditions are highly variable and omni-directional, there remains the possibility of interaction between different discharge plume types. Cumulative effects to the marine environment may result from these interactions and/or through combination with discharges from other users or facilities in the immediate region.

The subsea system is located in deep water and a considerable distance from the FLNG facility, therefore the small volume valve actuation discharges are not expected to interact with any other planned discharges and are not considered further from a cumulative impact perspective.

9.10.3.4.1 Prelude Liquid Discharges

Interactions of the various FLNG liquid discharge plumes may be possible under the following circumstances:

- The discharges are located in sufficient proximity so that the dynamic plumes may overlap (refer Figure 9-6)
- Certain or changing ambient current directions bring the plumes of the same or other discharges into the discharge path of a plume
- Severe conditions create substantial turbulence that allows interaction of plumes that are normally at different depths.

A study of the potential for the FLNG facility discharge plumes to interact, and the likely level of common constituent intersection and associated constituent compounding was undertaken (RPS 2019b) to inform cumulative impact assessment. This study (Section 9.10.2.2) calculated the defined fields of effect (impact area) of wastewater discharges from the Prelude FLNG, taking account of any comingling or cross-contamination potential. Such fields of effect were calculated as the maximum distance from the FLNG where concentrations might exceed Predicted No-Effect Concentrations (PNECs) for each constituent of concern calculated using available ecotoxicity data and applying the CIN (2017) methodology.

Liquid discharges undergo dilution through multiple processes:

- Turbulence generated by the momentum of the water passing through a restricted port
- Turbulence generated by the discharge jet penetrating the receiving water due to viscous resistance
- Dispersion occurring as the plume rises or sinks due to relative buoyancy
- Dispersion due to advection and turbulence present in the water column.

The first three processes are dominated by the characteristics of the discharge, including the flow rate, port size, orientation and water density, relative to the receiving water, and is complete within relatively short time and space scales. Hence, are commonly referred to as “near-field” processes. The fourth process will occur later and will be dependent upon the levels of mixing energy that are set up by ambient current and wave action around the discharge location. This fourth process occurs over longer time and space scales and is commonly referred to as the “far-field” process.

The study concluded that:

- Few discharges would have compounding effects, either because of different constituents and/or lack of significant comingling
- The drainage (slops) and bilge waste streams are expected to contain common contaminants (notably TPH) and are anticipated to comingle, but the resultant plume TPH concentration is predicted to be diluted to below 7 ppb within 200 m from the FLNG facility under the 99th percentile current regime. Due to separation (>400 m) from the PW discharge location, any influence of PW stream on the physical or chemical behaviour of these other discharge plumes is predicted to have no effect.
- Any interaction with or flow past the main CW discharges will result in entrainment within the CW plume and accelerated dilution due to increased energy and turbulence. Where prevailing current directions and speed result in plumes comingling, free chlorine has the potential to interact with some constituents in the PW discharge and form chemical complexes that may be toxic to marine organisms. However, the comingling and field validation (sampling) studies undertaken (Section 9.10.2) indicate the likelihood of these being present in significant concentrations beyond the immediate vicinity of the discharge source is very low.
- Given the high dilution, low volume and low toxicant concentrations, it is not anticipated that food, sewage or greywater discharges would result in any cumulative impacts amongst each other or any other liquid discharge streams.
- The desalination brine, MBP effluent and boiler blowdown discharges plumes may interact under certain circumstances. However, there will not be any considerable cumulative impacts associated with comingling due to the different additives and physical properties not presenting a feasible multiplication effect.

9.10.3.4.2 Other Users/Facility Discharges

Of the other operating oil and gas production facilities in the region, the Ichthys facilities are the closest, situated approximately 20 km south of the Activity Area. The Montara facility is located approximately 188 km north-east of the Activity Area and, once commissioned, the Crux platform will be operating ~160 km away. Bakke et al. (2013) states that typically no impacts due to discharges are detected beyond 2 km from offshore facilities around the world. Planned discharges from these facilities are reported to disperse rapidly within close proximity of discharge points (Inpex 2022; Jadestone Energy 2023; Shell 2024) and the combined area within the region potentially affected by liquid discharges from all of these facilities (inclusive of Prelude) represents a negligible proportion of the regional open ocean environment.

9.10.3.4.3 Cumulative Liquid Discharges Impact Summary

The RPS (2019b) modelling assessment shows that the potential cumulative impacts of all Prelude facility liquid discharges released simultaneously are not expected to exceed the predicted impact footprint of the worst-case discharges when assessed in isolation, i.e. Slight impacts will be contained within the 200m mixing zone from the FLNG described and assessed for PW as a standalone discharge stream (Section 9.9.3).

Given the localised mixing zone(s) for the Prelude discharges, limited synergistic effects of comingling and the distances to other sources of reduced water quality in the region, no significant cumulative impacts from planned discharges are expected for the activity, and no change to the overall consequence level to each receptor identified for liquid discharges is expected to result.

9.10.4 Impact Assessment Summary

Table 9-66 lists the highest residual impact consequence rankings of the relevant environmental receptor groups.

Table 9-66: Liquid Discharges Evaluation of Residual Impacts

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Evaluation – Planned Impacts			
Protected Areas	N/A	N/A	N/A
Physical Features	N/A	N/A	N/A
Physical Values and Sensitivities	−1	L	Slight
Natural Features	−1	L	Slight
Natural Values and Sensitivities	−1	M	Slight
Socioeconomic Features	N/A	N/A	N/A
Socioeconomic Values and Sensitivities	N/A	N/A	N/A
Heritage and Cultural Features	N/A	N/A	N/A
Heritage and Cultural Values and Sensitivities	N/A	N/A	N/A

9.10.5 ALARP Assessment and Environmental Performance Standards

Table 9-67: Drainage (Slops) and Bilge Waste Discharges – ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measures Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	Eliminate discharges from FLNG by storing all open drainage and bilge effluent to be transported and treated /disposed onshore.	No	There are significant costs and HSE risks associated with storing and transporting onshore all open drainage and bilge effluent on the marine support vessels and the FLNG. It is grossly disproportionate to the environmental impacts of onboard treatment prior to discharging overboard.	N/A	N/A	N/A
Substitution	Alternative technology to oil-water separator system.	No	The oil-water separator systems on the FLNG and vessels are standard MARPOL-compliant systems for management of accidentally-oil contaminated drainage and bilge in offshore installations and vessels. They are suitably effective to manage oil in water under the specified limits. On the FLNG there is also an option available to direct off-specification drainage effluent through the MPPE system if required.	N/A	N/A	N/A
Engineering	Management of monitoring of slops and bilge discharges including: • Drains system (as described in Section 6.9.13) • Dirty and clean slops tanks • Dirty and clean bilge tank • Oily water separator • Oil discharge monitoring equipment (ODME)	Yes	The slops and bilge systems receive both hazardous and non-hazardous streams from various locations on the FLNG through the drains system (described in Section 6.9.13). Two dirty slop tanks T-37001/3 are provided to collect liquid from tank cleaning operation, laboratory drain, open hazardous drain vessel, deck spill drain, bilge drain system and off-spec potentially contaminated condensate drain from tank cleaning heater. Sources undergo gravity separation within the dirty slops tanks, with the clean slop transferred to the two clean slop tanks T-37001/4, which also collect clean water from the tank washing header. Separated oil is transferred to the sludge tank, which can then be transferred to dirty slops tanks or offloaded via supply vessel. The clean slop tanks are pumped into the condensate offloading/transfer header from where it is discharged overboard. Sources entering the bilge system are from clean void spaces between cargo/machinery spaces. These machinery spaces contain STGs, potable water, service water, demineralised water, air compressors, cooling water, fire water, diesel oil, hydraulic oil, lubricating oil, sewage and grey water systems. The drain material is stored in dirty bilge holding tanks T-72001 (AFT), T-72003 (FWD), clean bilge holding tank T-72002 and sludge oil tank T-72501. Bilge wells are provided in the machinery space to collect the drain/spillage materials. The drained material from the wells is transferred using air driven diaphragm pumps to the tanks via separate headers. The content of the clean and dirty bilge holding tanks are treated by oily water separators (A-72001A/B/C), with the separated oil transferred to the sludge tank. However, provision has also been made to pump the dirty bilge holding tanks to slop tanks. The separated clean water from the separator is discharged overboard. Discharge of the both the slops and bilge are monitored with Oil Discharge Monitoring Equipment (ODME) to ensure that the discharge OIW limit of 15 mg/L is achieved. Discharges at this level are not expected to cause any significant impact to the marine environment given low flow rates and high dilutions close to the source. If the discharge limit is not achieved the water is automatically diverted through DCS logic back inboard for re-processing. If the online analysers are not functional, manual samples will be taken to facilitate determination of OIW concentration to allow batch discharges to occur where the batch concentration is confirmed below	8.1	Drainage effluent will not be discharged via the slops or bilge system if the 15 mg/L instantaneous oil in water limit is exceeded.	DCS/PI or laboratory records demonstrate no exceedances of the 15 mg/L oil in water discharge limit.
				8.2	When discharging slops/bilge, if the online analyser is not available; conduct manual lab analysis prior to discharge to verify that the OIW concentration does not exceed 15 mg/L.	Laboratory sample records confirm that the OIW concentration levels do not exceed 15 mg/L.
				8.3	The ODME is categorised as an ECE and is prioritised, maintained and confirmed to be functional in accordance with the CMMS.	ODME CMMS maintenance records.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measures Effectiveness	EPS #	EPS	Measurement Criteria
			the limit. Discharges at this level are not expected to cause any significant impact to the marine environment given low flow rates and high dilutions close to the source. Oil in water analysis requirements are defined in Prelude FLNG Oil in Water Analysis Terminology and Methodology (HSE_PRE_16227).			
Engineering	Marine support vessels to comply with Marine Order 91 (IOPP certificates).	Yes	The marine assurance system is administered by Shell's marine team and, amongst other relevant requirements, ensures contract vessels comply with MARPOL, *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Orders 91 and 96. The benefits outweigh the costs associated with implementing this control.	8.4	Marine assurance will be undertaken for vessels, including a check for valid and in date IOPP certificates (as required by vessel class requirements and type) and ISPP certificate (or equivalent voluntary statement of compliance audits where relevant) (as required by vessel class, size and type).	Records of marine assurance of vessels carried out consistent with the process outlined in section 10.9.4.1 including valid IOPP and ISPP certificates, as required by vessel class and type.
Administrative and Procedural	Spill kits onboard the FLNG and marine support vessels.	Yes	Storage and use of spill adsorbent and clean-up kits are inexpensive and low-maintenance. Accumulations of oil, grease and other contaminants will be collected and removed from the decks.	8.5	Spill kits are available on the FLNG and marine support vessels to clean up small accumulations of contaminants.	Records indicating spill kits are in place.
Administrative and Procedural	Shell Australia Chemical Management Process.	Yes	Shell has adopted a chemical selection and approval process in accordance with Shell's chemical selection and approval guidelines (as outlined in the Shell Australia Chemical Management Process and Shell Global Product Stewardship guidelines) to assess chemicals that may pose a risk of environmental impact via planned discharges. In addition, Shell complies with the Industrial Chemicals Environmental Management (Register) Act 2021 and associated legislative instruments, including the Industrial Chemicals Environmental Management (Register) Instrument 2022, which establish the Industrial Chemicals Environmental Management Standard (IChEMS). Under this framework, chemicals are scheduled according to their environmental risk, with Schedules 6 and 7 representing the highest concern. Chemicals that are prohibited or require specific risk management measures under these instruments are either excluded from use or managed in strict accordance with regulatory requirements. This approach ensures that environmental risks associated with chemical discharges are reduced to As Low As Reasonably Practicable (ALARP) and remain compliant with applicable Commonwealth legislation. Consideration is given to the schedule to which each chemical has been assigned under IChEMS, and all associated requirements are adhered to across the chemical lifecycle, including manufacturing, import/export, use, storage, and disposal, within Australia. Following the chemical management process (Section 10.4.6), together with compliance with the ICEMS Act and the Register Instrument, minimises the impact of chemicals used and discharged to ALARP levels.	7.21	Chemicals that are planned for discharge to sea meet the following criteria: • are substitution warning free and rated Gold, Silver, D, or E through the Offshore Chemical Notification Scheme (OCNS), or are considered to Pose Little or No Risk to the Environment (PLONOR) (listed by the Oslo and Paris Convention for the Protection of the Marine Environment of the North-east Atlantic [OSPAR] Commission), or have a complete ALARP assessment. • are screened against the IChEMS register with: ○ no use, importation or discharge of chemicals listed in Schedule 7 unless exempted under Commonwealth Legislation ○ a complete ALARP assessment for chemicals listed in Schedule 6	Chemical change assessment process forms outlined in the Shell Australia Chemical Management Process showing chemicals that are planned for discharge to sea are: • substitution warning free and are rated Gold, Silver, D, or E through the Offshore Chemical Notification Scheme (OCNS), or are considered to Pose Little or No Risk to the Environment (PLONOR) (listed by the Oslo and Paris Convention for the Protection of the Marine Environment of the North-east Atlantic [OSPAR] Commission), or have a complete ALARP assessment. • screened against the IChEMS register with: ○ no use, importation or discharge of chemicals listed in Schedule 7 unless exempted under Commonwealth Legislation ○ a complete ALARP assessment for chemicals listed in Schedule 6

ALARP Demonstration Statement

Based on the impact assessment outcomes and control measures that have been adopted, Shell considers that implementing the control measures are appropriate to manage the potential impacts and risks of drainage (slops) and bilge discharges associated with the activity. No additional, alternative, or improved controls were identified that could further reduce the impacts—beyond negligible environmental benefits if any—without disproportionate effort and cost. Therefore, the impacts and risks are considered to be reduced to ALARP.

Table 9-68: Sewage, Greywater and Food Waste Discharges - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	On board storage of sewage, greywater and food wastes for transport to and disposal at an onshore facility.	No	This option offers limited environmental benefit, as any changes to water quality beyond a localised mixing zone are likely to have no environmental effect. Any limited environmental benefit realised is considered to be grossly disproportionate to the increase in operational costs associated with additional transits to and from port, and the introduction of additional safety and environmental risks related to increased transit time and operation of additional vessels, plant and equipment.	N/A	N/A	N/A
Substitution	Use of sewage treatment system to treat all sewage prior to disposal.	No	Offers limited environmental benefit, as the addition of chemicals (such as flocculants and defoaming agents) would be required to treat the effluent. Though some reduction in the area impacted may occur this benefit is grossly disproportionate to the detrimental impacts associated with the addition of refined chemicals and the increased cost.	N/A	N/A	N/A
Substitution	Use of alternative treatment technologies.	No	As above, this option would offer limited environmental benefit and would be grossly disproportionate in comparison to the increased operational costs for maintenance and staffing due to performance challenges associated with these technologies (e.g. clogging of membranes/screens), as well as the increase in potential exposure of the workforce to pathogens associated with these waste streams.	N/A	N/A	N/A
Engineering	Vacuum Toilet System is utilised on the Prelude facility.	Yes	The vacuum toilet system reduces the particle size to aid in the rapid dispersion and biodegradation of this waste stream.	8.6	The vacuum toilet system is maintained in accordance with the CMMS to reduce sewage particle prior to discharge to sea.	CMMS maintenance Records
Engineering	Further treatment e.g. disinfection of the waste-stream prior to discharge.	No	There are no known sensitive receptors to human pathogens in the vicinity of the discharge location that may be impacted therefore disinfection of the waste stream is not considered to provide a reduction in the impact. Additionally, not dosing the waste stream with a disinfectant such as chlorine will avoid potential cumulative impacts with other chlorine dosed streams such as cooling water. Furthermore, the consumption of disinfection chemicals, the resources consumed to transport the chemicals, and the risk of excess chlorine being released into the sea are grossly disproportionate to the negligible environmental benefits of disinfecting treated sewage effluent prior to discharge.	N/A	N/A	N/A
Engineering, Administrative and Procedural	Marine support vessels and the Prelude FLNG will comply with Marine Orders 94 and 95 (Marine pollution prevention – packaged harmful substances/garbage), specifically: • no planned disposal of domestic waste, solid wastes or maintenance wastes overboard from vessels (other than planned	Yes	The marine assurance system is administered by Shell's marine team and, amongst other relevant requirements, ensures contract vessels comply with MARPOL, *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Orders 94 and 95. The benefits outweigh the costs associated with implementing this control.	8.7	Marine support vessels and the Prelude FLNG will comply with Marine Orders 94 and 95 (Marine pollution prevention – packaged harmful substances/garbage), specifically: • no planned disposal of domestic waste, solid wastes or maintenance wastes overboard from vessels (other than planned discharges permitted by this EP). • food waste discharges macerated to <25 mm particle size.	Records of marine assurance of vessels carried out are consistent with the process outlined in section 10.9.4.1 including valid IOPP and ISPP certificates, as required by vessel class and type. Macerator maintenance records.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
	discharges permitted by this EP). • food waste discharges macerated to <25 mm particle size.					
Engineering, Administrative and Procedural	Marine support vessels routine discharges of treated sewage and greywater will comply with *Navigation Act 2012* (Cth), *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Order 96 (International Sewage Pollution Prevention [ISPP] certificates) as relevant to vessel class, size and type.	Yes	The marine assurance system is administered by Shell's marine team and, amongst other relevant requirements, ensures contract vessels comply with MARPOL, *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Orders 91 and 96. The benefits outweigh the costs associated with implementing this control.	8.4	Marine assurance will be undertaken for vessels, including a check for valid and in date IOPP certificates (as required by vessel class requirements and type) and ISPP certificate (or equivalent voluntary statement of compliance audits where relevant) (as required by vessel class, size and type).	Records of marine assurance of vessels carried out consistent with the process outlined in section 10.9.4.1 including valid IOPP and ISPP certificates, as required by vessel class and type.
Administrative and Procedural	Marine support vessels will maintain a Garbage Management Plan (or equivalent) as required by vessel class, size and type.	Yes	Documented requirements for garbage management reduce the risk of release through inadvertent discharge or incorrect storage/handling. Vessels are required to have their own Garbage record book (or equivalent) to manage wastes generated and stored onboard. All wastes that are not permitted for discharge are sent ashore for re-use, treatment, recycling and/or disposal as appropriate. This control measure is in accordance with *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Orders 94 and 95.	8.8	Marine support vessels (to which MARPOL Annex V/ Marine Order 95 applies) have a current Garbage Management Plan (or equivalent, as required by vessel class, size and type).	Records of marine assurance of vessels carried out consistent with the process outlined in section 10.9.4.1 including valid IOPP and ISPP certificates, as required by vessel class and type.
ALARP Demonstration Statement						
Based on the impact assessment outcomes and control measures that have been adopted, Shell considers that implementing the control measures are appropriate to manage the potential impacts and risks of sewage, greywater and food waste discharges associated with the activity. No additional, alternative, or improved controls were identified that could further reduce the impacts—beyond negligible environmental benefits if any—without disproportionate effort and cost. Therefore, the impacts and risks are considered to be reduced to ALARP.						

Table 9-69: Cooling Water - Discharges ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	N/A	N/A	Cooling is required for the FLNG facility from a safety and technical integrity perspective as part of the hydrocarbon production process and associated utilities for personnel. As such, cooling water discharge cannot be avoided. Collecting, storing, and transporting all CW discharges to shore is not a reasonably practicable alternative, due to technical, financial, and health and safety costs.	N/A	N/A	N/A
Substitution	Use of air-cooling instead of cooling water	No	Although air cooling is a technology tested for most onshore LNG facilities, water cooling is assessed as more efficient for the offshore FLNG facility. Air-cooling would require additional energy (fuel gas burnt) and equipment which will not fit on the FLNG from a structural perspective. The discharge of recycled seawater poses minimal environmental impact vs. burning more fossil fuels. The use of air for cooling also doesn't completely eliminate the requirement for seawater discharges.	N/A	N/A	N/A
Substitution	Use alternatives to hypochlorite	No	Hypochlorite is produced on the facility from seawater via the seawater intakes and is used to prevent biofouling to ensure the	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			continued operability and integrity of the seawater system. Other chemicals were considered during the design phase of the Project but ruled out for technical, commercial, logistical and safety risk associated with transporting, handling and storing the quantity of chemicals required. This transporting, storing and handling risk is grossly disproportionate to the negligible environmental gain of substituting the hypochlorite discharge for a different chemical. Hypochlorite is readily generated from seawater which eliminates this risk.			
Substitution	Use of alternative systems for biofouling control	No	Copper-chlorine system: This process utilises sodium hypochlorite (generated as for electrochlorination) with the toxicity to fouling organisms boosted by copper ions generated in a dosing chamber from sacrificial copper electrodes. The copper and chlorine act on the cell membranes of the fouling organisms. Due to the synergy of their action, dosage requirements are significantly reduced (approximately 5 ppb copper and 50 ppb hypochlorite). Levels of copper from anti-biofouling systems have been measured by the US Uniform National Discharge Standards (UNDS) Program (US EPA [1999]). Their research has shown that the concentration of copper discharged from anti-biofouling systems is between 0.52 and 0.69 ppb which is above the ANZECC (2018) DGV for copper which may introduce additional environmental risk in isolation or cumulatively with chlorine as an additive effect. Copper-aluminium-chlorine system: This process is similar to the copper-chlorine process. The major difference is that the seawater is passed through an ion vessel that uses an impressed current method to selectively dissolve copper and aluminium. This is again mixed with sodium hypochlorite prior to dosing the system. So, although the concentration of residual chlorine could be reduced by the use of copper-chlorine or copper-aluminium-chlorine systems, there is potentially no environmental benefit gained as it introduces additional contaminants that are toxic.	N/A	N/A	N/A
Engineering	Chlorine neutralisation (Dechlorination)	No	Dechlorination is the process of removing residual (free) chlorine from disinfected wastewater prior to discharge into the environment. This process reduces the effect of potentially toxic disinfection by-products by removing the free/residual chlorine remaining after chlorination. Further engineering changes to provide additional treatment prior to the final discharge, would require additional equipment, imposing significant additional space and weight requirements, which are not available on the FLNG from a structural perspective. Furthermore, with major financial costs, for negligible environmental benefit at this location given the slight residual environmental impact presented by the resultant plume. Treatment of the CW prior to discharge introduces additional safety risk associated with transporting, handling and storing the quantity of de-chlorination chemicals required which is grossly disproportionate to the negligible environment benefit that may be gained.	N/A	N/A	N/A
Engineering	Chlorine Adsorption	No	Carbon adsorption is usually implemented when total dechlorination is desired. Carbon adsorption can be an effective dechlorination method, but is impractical on an FLNG scale whereby numerous carbon filters would be required to treat a throughput of ~80,000 m^3/hr. Not only will	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			this be impractical from a space-structural perspective on the FLNG, filtering seawater (which contain salts and impurities) would constantly block the filters, requiring frequent change outs and generation of additional waste. Furthermore, this option introduces capital, ongoing costs and waste grossly disproportionate to the negligible environmental gain of further reducing chlorine concentrations in the CW streams.			
Engineering	Additional residence time and/or treatment prior to discharge	No	Further engineering changes to provide additional treatment and/or storage prior to the final discharge would require additional equipment, imposing significant additional space and weight requirements. Based on the residence time required in a vessel, with the throughput of ~80,000 m^3/hr, a vessel of 320,000 m^3 (greater than the volume of all of Prelude's 6 LNG Tanks) is required which is not feasible to retrofit onto the FLNG. Costs grossly disproportionate to the negligible environmental benefit at this location given the predicted impact footprint is already small and very localised.	N/A	N/A	N/A
Engineering	Supply of colder seawater sourced from 150 m water and use as a cooling medium for the main process cooling requirements.	Yes	At a depth of 150 m, the seawater supply for SW2 is nearly constant at a temperature of 21–22°C resulting in a lower temperature delta for discharges from this system relative to ambient seawater temperature compared to the scenario of warmer CW being drawn from nearer the surface. Taking this quantity of seawater 150 m below surface rather than at surface is novel for FLNG from a design, construction and installation perspective and enhances the energy efficiency of the facility (i.e. reduction in the GHG emissions footprint, refer to Section 9.12). As this is an inherent design feature of the facility no EPS is included for this control.	N/A	N/A - The design features of the CW system were selected, installed and commissioned prior to the period covered by this EP, and are therefore not described in further detail here as an EPS.	N/A
Engineering	Inlet hypochlorite injection concentration control	No	A change in control philosophy based on a fixed target hypochlorite injection concentration was considered. However, due to fluctuating efficiency of the ECU, mostly attributed to acid washing, would result in providing a fluctuating ECU outlet stream. Furthermore, the chlorine demand is dependent on the chemical composition of the seawater and the amount of biological life, both of which are affected by multiple factors requiring varying chlorine demand over time. It is highly unlikely to achieve a constant residual chlorine concentration at the outfall discharge point. To ensure a positive range of free residual chlorine concentration at any given time, a relatively high injection concentration would have to be applied, which will result in higher concentration of chlorine in discharged effluent. Thus, to ensure a constant injection concentration, analyser equipment would have to be retrofitted on the facility, downstream of the ECU.	N/A	N/A	N/A
Engineering	Decrease ECU throughput to manage excess hypochlorite	No	A minimum flow must be maintained through the ECU to ensure safe and reliable operation of the system. In the rare occasions when one or more larger seawater users, such as SW2 and SW4, are not in operation there will be an excess production of hypochlorite available in the system which will need to be managed. The throughput of the ECU system cannot be decreased sufficiently to match the maximum flow capacity of the online seawater system (e.g. SW3). To manage excess hypochlorite, hypochlorite will be discharged to seachests	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			which are not operating. Flow to the online seawater system will always be maximised first to minimise the amount of excess hypochlorite.			
Engineering, Administrative and Procedural	Optimised operation of the seawater water system to maintain and monitor the required chlorine levels to ensure system integrity is maintained including: • An Electro-Chlorination System (ECU) for the production of sodium hypochlorite • Monitoring of chlorine concentrations with a real time calculation via DCS with alarms, outlined in standing instructions to operators • Ability to conduct manual sampling if the DCS calculation is unavailable • Control and minimise use of shock dosing • Maintenance of the system in accordance with the CMMS as defined in Section 10.5.8 and 10.5.9	Yes	Seawater loops provide cooling for processes and essential equipment. Hypochlorite solution is injected to prevent marine growth in the system. **ECU** The ECU provides hypochlorite solution in variable concentrations to achieve the dosing requirements to seawater loops. **Discharge Monitoring and Alarms** Chlorine concentrations at the outfall of each seawater circuit are monitored via a real time calculation which is integrated into DCS to provide allow real time management of the system. Alarms are set against instantaneous calculation values at a high point below limit to maintain chlorine concentration levels, which are managed with pre-determined troubleshooting actions to enable action prior to a limit exceedance to reduce their frequency and duration. Based on operational experience, the free residual chlorine discharge limit was most recently revised to a timed average of 0.6 mg/L for each seawater loop. As per the Alarm Management Manual, Critical Alarms are red flashing with an audible tone and the response principle is immediate emergency corrective actions to get the variable back within Variable Table (VT) limits. For residual chlorine alarms, examples of the VT operator actions may include: 1. Confirm shock dosing is not in progress 2. Adjust injection rate if required 3. Reduce ECU current to decrease hypochlorite concentration. Seawater loops are expected to be controlled within target limits. High alarms alert operations to ensure the 0.6 mg/L limit is not exceeded (EPS 8.9). The likely response to an exceedance of the critical alarm will be a reduction in ECU currents, which should result in a reduction in chlorine discharge concentrations in a matter of minutes from executing the action. **Shock Dosing** Shock dosing is not anticipated to be used regularly for the Prelude seawater system. However, during certain circumstances such as following extended shutdowns or persistent biofouling during normal operations, there may be a need for shock dosing to manage marine growth. Shock dosing would only be considered when biofouling is likely or known to be increasing within the seawater system under shutdown or normal seawater system operating circumstances. Planned and unplanned shutdowns of seawater systems are infrequent and are not expected to occur more than once or twice per year.	8.9	To minimise the risk of system failures such as line blockages, the ECU is categorised as an ECE and is prioritised, maintained and confirmed to be functional in accordance with the CMMS.	ECU CMMS maintenance records.
				8.10	Chlorine concentrations are monitored via a real time calculation integrated into the DCS with set alarms at 0.5 mg/L (high) and 0.6 mg/L (critical), to confirm chlorine discharge does not exceed an average limit of 0.6 mg/L across 1 hour for the respective seawater circuit.	DCS/PI records of chlorine concentrations and operator response Alarm logic in place.
				8.11	Chlorine calculations are validated with monthly manual sampling and where required adjusted accordingly.	Laboratory sampling records and evidence of validation against calculation records.
				8.12	If the online calculation is unavailable manual sampling will be conducted at least once per 24 hr period provided sampling and analysis can be conducted safely to confirm the chlorine discharge does not exceed an average limit of 0.6mg/L across an approximately 2-hour period (required for sampling processing time).	Laboratory sampling records.
				8.13	Shock dosing in the seawater system will not exceed 1 hour per 24 hours and shock dosing will not exceed an instantaneous limit of 3.2 mg/L across 1 hour on calculated values or within a 2-hour period for manual sampling.	DCS/PI or laboratory records of chlorine discharge concentration.
				8.14	Shock dosing will only be initiated when biofouling is likely or known to be increasing within the seawater system under shutdown or normal seawater system operating circumstances.	DCS/PI records of differential pressure
Administrative and Procedural	Decreasing the chlorine dosing level of the CW	No	The hypochlorite dosing range and subsequent residual chlorine discharge high alarm of 0.5 mg/L with occasional shock dosing of up	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			to 3.2 mg/L is selected to ensure the chlorine concentration is sufficient to prevent biofouling throughout the seawater system. Decreasing the dosing concentration can potentially allow biofouling to proliferate in the seawater system. This can compromise the integrity and functionality of the water systems, leading to significant technical issues, and increased risk of loss of hydrocarbon containment scenarios, with intolerable safety risks, as well as increased potential environmental release scenarios to the marine environment. Fouling of the system would also decrease the energy efficiency of the facility resulting in higher volumes of GHG production.			
ALARP Demonstration Statement						
Based on the impact assessment outcomes and control measures that have been adopted, Shell considers that implementing the control measures are appropriate to manage the potential impacts and risks of cooling water discharges associated with the activity. No additional, alternative, or improved controls were identified that could further reduce the impacts—beyond negligible environmental benefits if any—without disproportionate effort and cost. Therefore, the impacts and risks are considered to be reduced to ALARP.						

Table 9-70: Desalination Brine, MBP and Boiler Blowdown Effluent Discharge - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	N/A	N/A	The use of the seawater distillation system and discharge of boiler blowdown water are common and accepted practice for vessels and offshore oil and gas facilities. Offshore activities cannot operate without fresh water.	N/A	N/A	N/A
Substitution	Source all freshwater from onshore.	No	The elimination of the desalination plants to prevent the generation of brine water and MBP effluent would shift the sourcing of water to an onshore resource to 100%. This would increase demand on onshore water supply sources (e.g. Darwin or Broome). It would also result in a high number of vessel movements between the FLNG and port, resulting in increased personnel hours (and therefore cost) and increased diesel use (increased air emissions, waste water discharges [including brine water] and cost). The increased financial and environmental cost of this substitute measure is grossly disproportionate to the low environmental impact of brine and MBP effluent discharges.	N/A	N/A	N/A
Engineering	Storing waste effluent onboard and transporting for onshore treatment and/or disposal.	No	Storing on-board and then transferring it to shore results in increased personnel and environmental costs associated with more vessel movements (as outlined above), and is also not possible given that the required storage space would not be available on the FLNG and marine support vessels.	N/A	N/A	N/A
Administrative and Procedural	Shell Australia Chemical Management Process.	Yes	Shell has adopted a chemical selection and approval process in accordance with Shell's chemical selection and approval guidelines (as outlined in the Shell Australia Chemical Management Process and Shell Global Product Stewardship guidelines) to assess chemicals that may pose a risk of environmental impact via planned discharges. In addition, Shell complies with the Industrial Chemicals Environmental Management (Register) Act 2021 and associated legislative instruments, including the Industrial Chemicals Environmental Management (Register) Instrument 2022, which establish the Industrial Chemicals Environmental Management	7.21	Chemicals that are planned for discharge to sea meet the following criteria: • are substitution warning free and rated Gold, Silver, D, or E through the Offshore Chemical Notification Scheme (OCNS), or are considered to Pose Little or No Risk to the Environment (PLONOR) (listed by the Oslo and Paris Convention for the Protection of the Marine Environment of the North-east Atlantic	Chemical change assessment process forms outlined in the Shell Australia Chemical Management Process showing chemicals that are planned for discharge to sea are: • substitution warning free and are rated Gold, Silver, D, or E through the Offshore Chemical Notification Scheme (OCNS), or are considered to Pose Little or No Risk to the Environment (PLONOR) (listed by the Oslo and Paris Convention for the Protection of the Marine Environment of the North-east Atlantic

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			Standard (IChEMS). Under this framework, chemicals are scheduled according to their environmental risk, with Schedules 6 and 7 representing the highest concern. Chemicals that are prohibited or require specific risk management measures under these instruments are either excluded from use or managed in strict accordance with regulatory requirements. This approach ensures that environmental risks associated with chemical discharges are reduced to As Low As Reasonably Practicable (ALARP) and remain compliant with applicable Commonwealth legislation. Consideration is given to the schedule to which each chemical has been assigned under IChEMS, and all associated requirements are adhered to across the chemical lifecycle, including manufacturing, import/export, use, storage, and disposal, within Australia. Following the chemical management process (Section 10.4.6) together with compliance with the ICEMR Act and the Register Instrument, minimises the impact of chemicals used and discharged to ALARP levels.		[OSPAR] Commission), or have a complete ALARP assessment. • are screened against the IChEMS register with: ○ no use, importation or discharge of chemicals listed in Schedule 7 unless exempted under Commonwealth Legislation ○ a complete ALARP assessment for chemicals listed in Schedule 6	[OSPAR] Commission), or have a complete ALARP assessment. • screened against the IChEMS register with: ○ no use, importation or discharge of chemicals listed in Schedule 7 unless exempted under Commonwealth Legislation ○ a complete ALARP assessment for chemicals listed in Schedule 6
Administrative and Procedural	The boiler blow-down and neutralisation tank discharges are monitored either by online analyser or manually for pH.	Yes	pH is monitored to measure the efficiency of each system and to understand neutralisation requirements prior to discharge.	8.15	The boiler blow-down and neutralisation tank discharges are discharged within a pH 6-12 range, with monitoring via an on-line pH analyser or laboratory sampling if the analyser is unavailable.	DCS/PI records or laboratory records if analyser is unavailable.
				8.16	The pH analysers are categorised as ECEs and are prioritised, maintained and confirmed to be functional in accordance with the CMMS.	CMMS records.
ALARP Demonstration Statement						
Based on the impact assessment outcomes and control measures that have been adopted, Shell considers that implementing the control measures are appropriate to manage the potential impacts and risks of desalination brine, MBP and boiler blowdown effluent discharges associated with the activity. No additional, alternative, or improved controls were identified that could further reduce the impacts—beyond negligible environmental benefits if any—without disproportionate effort and cost. Therefore, the impacts and risks are considered to be reduced to ALARP.						

Table 9-71: Use and Discharge of Ad-Hoc Chemicals - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	N/A	N/A	The use of chemicals cannot be eliminated from the operation, preservation and maintenance of the FLNG, subsea facilities and support vessels.	N/A	N/A	N/A
Engineering	The subsea facilities are designed to minimise release of fluids to the environment.	Yes	Because of the design, only incidental releases during valve actuations, tie-ins and connections and during subsea interventions are expected.	8.17	Subsea actuation valves are prioritised, maintained and confirmed to be functional in accordance with the CMMS.	Subsea actuation valve CMMS maintenance records.
Engineering	Equipment to capture or collect subsea discharges.	No	No practicable engineering controls are available that are proven to be able to capture or contain subsea discharges. Designing and installing a temporary capture system would result in significant financial costs, with technical uncertainty, grossly disproportionate to any slight increase in environmental benefit of preventing small and infrequent discharges.	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Administrative and Procedural	Management of ad hoc and non-routine through implementation of the Shell MOC Manual as defined in Section 10.4.4.	Yes	Re-processing or onshore disposal of chemically dosed liquids may be a practicable control measure for certain activities or circumstances. This will be assessed on a case-by-case basis and documented accordingly via the MOC process (Section 10.4.4). Any fluid discharges as a result of the activities would be controlled and minimised through the system isolations prior to conducting the activity, thereby limiting the potential discharge volumes to that which is contained within the targeted and isolatable section of the containment vessel. The MOC will detail any isolation steps for the specific components of the system before activities commence to reduce resultant discharge volumes to ALARP.	8.18	Ad Hoc/Non-routine discharges with chemical additives are assessed and approved through implementation of the Shell MOC Manual (defined in Section 10.4.4) prior to release.	Records of completed and approved MOCs for ad hoc/nonroutine discharges.
Administrative and Procedural	Infield water quality monitoring of Ad-Hoc, IMR, installation and/or commissioning based discharges.	No	Infield water quality monitoring could be used to verify the predicted low risk associated with minor amounts and low frequency of IMR, installation and/or commissioning fluids planned to be discharged to the ocean. Monitoring could not be used to inform adaptive management of these discharges due to their intermittent/infrequent occurrence over short periods (typically minutes to hours). Given the typically low volumes, concentration and frequencies of the discharges and the slight associated residual impacts, it is not considered to be practicable to undertake infield monitoring as the cost (financial and safety) of implementation is grossly disproportionate to any potential further reduction in environmental impact.	N/A	N/A	N/A
Administrative and Procedural	Shell Australia Chemical Management Process.	Yes	Shell has adopted a chemical selection and approval process in accordance with Shell's chemical selection and approval guidelines (as outlined in the Shell Australia Chemical Management Process and Shell Global Product Stewardship guidelines) to assess chemicals that may pose a risk of environmental impact via planned discharges. In addition, Shell complies with the Industrial Chemicals Environmental Management (Register) Act 2021 and associated legislative instruments, including the Industrial Chemicals Environmental Management (Register) Instrument 2022, which establish the Industrial Chemicals Environmental Management Standard (IChEMS). Under this framework, chemicals are scheduled according to their environmental risk, with Schedules 6 and 7 representing the highest concern. Chemicals that are prohibited or require specific risk management measures under these instruments are either excluded from use or managed in strict accordance with regulatory requirements. This approach ensures that environmental risks associated with chemical discharges are reduced to As Low As Reasonably Practicable (ALARP) and remain compliant with applicable Commonwealth legislation. Consideration is given to the schedule to which each chemical has been assigned under IChEMS, and all associated requirements are adhered to across the chemical lifecycle, including manufacturing, import/export, use, storage, and disposal, within Australia. Following the chemical management process (Section 10.4.6), together with compliance with the ICEMR Act and the Register	7.21	Chemicals that are planned for discharge to sea meet the following criteria: • are substitution warning free and rated Gold, Silver, D, or E through the Offshore Chemical Notification Scheme (OCNS), or are considered to Pose Little or No Risk to the Environment (PLONOR) (listed by the Oslo and Paris Convention for the Protection of the Marine Environment of the North-east Atlantic [OSPAR] Commission), or have a complete ALARP assessment. • are screened against the IChEMS register with: ○ no use, importation or discharge of chemicals listed in Schedule 7 unless exempted under Commonwealth Legislation ○ a complete ALARP assessment for chemicals listed in Schedule 6	Chemical change assessment process forms outlined in the Shell Australia Chemical Management Process showing chemicals that are planned for discharge to sea are: • substitution warning free and are rated Gold, Silver, D, or E through the Offshore Chemical Notification Scheme (OCNS), or are considered to Pose Little or No Risk to the Environment (PLONOR) (listed by the Oslo and Paris Convention for the Protection of the Marine Environment of the North-east Atlantic [OSPAR] Commission), or have a complete ALARP assessment. • screened against the IChEMS register with: ○ no use, importation or discharge of chemicals listed in Schedule 7 unless exempted under Commonwealth Legislation ○ a complete ALARP assessment for chemicals listed in Schedule 6

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			Instrument, minimises the impact of chemicals used and discharged to ALARP levels.			
ALARP Demonstration Statement						
Based on the impact assessment outcomes and control measures that have been adopted, Shell considers that implementing the control measures are appropriate to manage the potential impacts and risks associated with the use and discharge of ad-hoc chemicals associated with the activity. No additional, alternative, or improved controls were identified that could further reduce the impacts—beyond negligible environmental benefits if any—without disproportionate effort and cost. Therefore, the impacts and risks are considered to be reduced to ALARP.						

9.10.6 Acceptability of Impacts

Table 9-72: Acceptability of Impacts – Other Liquid Discharges

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Sub-category**			
Physical features, values and sensitivities	Water Quality	No significant impacts to water quality. Impact not expected to result in a substantial change in water quality, which may adversely impact biodiversity, ecological integrity, social amenity or human health.	Yes	Liquid discharges have the potential to result in reduced water quality in the immediate vicinity of the discharge location, however discharges will rapidly dilute and disperse in the open ocean environment. Modelling and monitoring studies for the Prelude discharges indicate impacts to water quality are likely to be highly localised around the discharge locations, which is consistent with industry monitoring studies and demonstrates high confidence in the assessment that ecological integrity, social amenity and human health values will not be significantly or substantially impacted. Liquid discharges from the FLNG cannot be avoided. However, the area influenced from routine operational discharges (excluding PW) is expected to be limited to within <200m of the liquid discharge locations. There is no recreational use of the area involved and the potential magnitude of impacts to marine ecosystems is slight. Given the offshore location and absence of particularly sensitive marine ecosystems at the FLNG location and immediate surrounds, potential impacts within <200 m of the FLNG are considered acceptable.
Natural features, values and sensitivities	Marine bioregions	No significant impacts to benthic habitats and communities. No significant adverse effect on demersal or pelagic communities, populations, habitats or spatial distribution of a species. No substantial adverse effect on a population of a marine species	Yes	Liquid discharges from the FLNG facility are predicted to be rapidly dispersed within surface or near-surface waters with no potential for exposure above impact concentrations to benthic or demersal communities. Routine operational discharges and potential discharges during IMR activities associated with subsurface infrastructure involve small volumes and are intermittent, with potential effects expected to be highly localised and temporary with no impact to benthic habitats anticipated.

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	Sub-category			
		including its lifecycle and spatial distribution. No known or potential pest species become established in the Commonwealth Marine Area.		Modelling studies indicate that impacts to water quality will be localised around the FLNG which is characterised as open offshore waters, typical of the offshore Browse Basin. Considering the transient presence of pelagic species, absence of important habitat or aggregation areas within the area potentially affected, and the results of monitoring, there is high confidence that potential impacts to pelagic communities will be slight and there will not be any significant adverse effect on pelagic species lifecycles, populations, habitats or spatial distribution. Given the offshore location and absence of particularly sensitive marine ecosystems at the FLNG location and immediate surrounds, potential impacts within <200 m of the FLNG are considered acceptable
	Threatened and Migratory Species	No mortality or injury of cetaceans. Management of aspects of the activity must align with conservation advice, recovery plans and threat abatement plans (Refer to Table 8-1). No significant impacts to EPBC Act listed threatened, migratory, marine or cetacean species.	Yes	Most threatened and/or migratory fauna species within the area predicted to be influenced by planned liquid discharges are air breathing vertebrates, which are unlikely to be directly affected as their skin is relatively impermeable and they breathe air. Hence, direct impacts are not considered credible. Non-air breathing species are not anticipated to be present in significant numbers nor be exposed to levels that may adversely impact on individuals and therefore there will be no significant impacts. Management of the aspects of the activity align with conservation advice, recovery plans and threat abatement plans as per Table 9-73

The assessment of impacts from liquid discharges determined the residual impact consequence to be Slight (Table 9-66). The acceptability of the potential impacts from liquid discharges associated with the petroleum activity have been considered in the following context:

Principles of ESD

The potential impacts from liquid discharges are consistent with the principles of ESD because:

- The environmental receptors within the Activity Area are not expected to be significantly impacted; and
- The precautionary principle has been applied, and reviews were undertaken where knowledge gaps were identified. This knowledge was applied when evaluating environmental impacts.

Relevant Requirements

Managing the potential impacts from liquid discharges is consistent with relevant requirements, including:

- Compliance with international maritime conventions, including:
  - MARPOL:
    - Annex I: regulations for the prevention of pollution by oil
    - Annex II: regulations for the control of pollution by noxious liquid substances in bulk
    - Annex III: regulations for the prevention of pollution by harmful substances carried by sea in packaged form, and
    - Annex IV: regulations for the prevention of pollution by sewage from ships
    - Annex V: (regulation for the prevention of pollution by garbage from ships).
- Compliance with legislation and requirements, including:
  - Navigation Act 2012 (Cth) and Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth):
    - Marine Order 91 (Marine pollution prevention – oil)
    - Marine Order 93 (Marine pollution prevention – noxious liquid substances)
    - Marine Order 94 (Marine pollution prevention – packages harmful substances)
    - Marine Order 95 (Marine pollution prevention – garbage)
    - Marine Order 96 (Marine pollution prevention – sewage).
- Management of impacts and risks are consistent with policies, strategies, guidelines, conservation advice, and recovery plans for threatened species (Table 9-73)
- Implementation of recognised industry standard practice, such as:
  - Treatment of collected drainage bilge water to <15 mg/L residual oil
  - IFC (2015) standard for water temperature which requires that the effluent should not result in a temperature increase of greater than 3°C compared to the ambient temperature at the edge of a default 100m mixing zone.

Matters of National Environmental Significance

Threatened and Migratory Species

The evaluation of liquid discharges predicts that there will no credible risk of significant impacts to threatened and migratory species as a result of liquid discharges during the Prelude petroleum activities. Table 9-73 summarises the alignment of the petroleum activities with management plans, recovery plans and conservation advice for threatened and migratory fauna.

Commonwealth Marine Area

The potential impacts and risks from the liquid discharges aspect on the Commonwealth marine environment are not predicted to exceed any of the significant impact criteria as listed in Table 9-73. Hence, it is considered that the activity does not pose a credible risk to the Commonwealth Marine environment.

Table 9-73: Summary of Alignment with Relevant MNES Considerations

MNES	MNES Acceptability Considerations	Demonstration of Alignment as Relevant to the Project
Threatened and Migratory Species	Significant impact guidelines for Critically Endangered, Endangered, Vulnerable and Migratory species (Table 8-1)	The application of the Shell Chemical Management Process and proposed management controls for liquid discharges reduces the impact of toxic pollutants being introduced into and/or persisting in the marine environment. An adaptive environmental monitoring and management program has been developed for liquid discharges as described in Section 10.8. This program will seek to demonstrate that the actual levels of recorded impacts for key discharges do not exceed those which were predicted within the impact assessment presented in this EP. If recorded impact levels do exceed those described, this would trigger the adaptive management process and assessment under the Shell MOC Manual (Refer to Section 10.4.4.)
	Conservation advice on *Balaenoptera borealis* (sei whale) (DoE 2015c)	
	Conservation advice fin whale (*Balaenoptera physalus*) (DoE 2015d)	
	Recovery plan for marine turtles in Australia (CoA 2017b)	
	Conservation advice on *Rhincodon typus* (whale shark) (DoE 2015e)	
	Conservation management plan for the blue whale: A recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999 2015-2025* (CoA 2015a).	
Commonwealth Marine Area	Significant impact guidelines for Commonwealth marine environment (Table 8-1)	Water quality impacts as a results of routine operational discharges (excluding PW) are expected to be limited to within <200 m of the FLNG for all collective discharge streams. Impacts confined within this area are not considered to be significant in the context of the significant impact criteria for the Commonwealth Marine Area given the nature and scale of the impacts and the characteristics of the local receiving environment (open offshore waters with regionally well represented soft and bare sandy sediments). The impact assessment indicates the impacts associated with the discharge of liquid discharges will not result in a significant adverse impact on marine ecosystem functioning/integrity, social amenity or human health. Shell has sought to reduce potential impacts through the selection and implementation of the controls and EPSs listed in Section 9.10.5.

External Context

No objections or claims have been raised by relevant persons to date regarding liquid discharges. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4.

Internal Context

Shell also considered the internal context, including Shell's environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented for the activity are consistent with the outcomes from consultation for the petroleum activity and Shell's internal requirements.

Acceptability Summary

The assessment of potential impacts and risks from liquid discharges determined the residual impacts rankings to be Slight (Table 9-66). The acceptability of the impacts have been considered in the context of:

- The established acceptability criteria for the liquid discharges aspect
- ESD
- Relevant requirements
- MNES
- External context (i.e. relevant persons claims or objections)
- Internal context (i.e. Shell requirements).

Shell considers residual impacts of Minor or lower to be acceptable if they meet legislative and Shell requirements. The discussion above demonstrates that these requirements have been met in relation to the liquid discharges aspect.

Shell considers the potential for impacts from liquid discharges associated with the Activity to be ALARP and acceptable.

9.10.7 Environmental Performance Outcomes

EPO #	EPO	Measurement Criteria
2.1	No injury or mortality of threatened, migratory or cetacean species associated with the Activities.	Reports of injury or mortality of EPBC listed threatened, migratory or cetacean species associated with the Activities sent to NOPSEMA and DCCEEW in accordance with requirements outlined in Table 10-13.
8.1	No impact to water quality outside of the 200m mixing zone for other liquid discharges.	Monitoring records.

9.11 Atmospheric Emissions

9.11.1 Aspect Context

Atmospheric emissions are the gases and particulates released into the atmosphere from an activity that may have an adverse effect on the environment. Atmospheric emissions that have the potential to impact local and regional air quality include pollutants such as nitrogen oxides (NO_x)[36], sulphur oxides (SO_x)[37], carbon monoxide (CO), particulate matter less than 10 microns (PM_{10})[38]; and air toxics such as volatile organic compounds (VOCs) which includes BTEX and hydrogen sulphide which may be released to the atmosphere as a result of combustion processes on the Prelude FLNG facility or vessels, emission alongside combustion byproducts, or leakage through vents, emission points or other equipment. Fuel gas sourced from the Prelude wells is expected to be low in sulphur and may contain impurities from the reservoirs, such as mercury (further detailed in Section 9.11.1.1) and carbon dioxide (CO_2), that may also be carried forward into the fuel gas system and, therefore, gas turbines and flare systems.

Atmospheric emissions associated with the activity will be generated by a variety of sources, including:

- Combustion of fuels that will release atmospheric emissions in exhaust gas. Sources include:
  - Propulsion and electricity generation engines on marine vessels and helicopter operations supporting Prelude. Operations support marine vessels include dedicated supply vessels, infield support vessels/ pilot tugs and campaign specific vessels (e.g. Inspection, Maintenance and Repair vessels).
  - Propulsion and electricity generation engines of LNG, LPG and condensate carriers.
  - The seven (7) 200 MW Marine Boilers on Prelude can operate on fuel gas or diesel. In normal operations, the boilers run on fuel gas in a 6 + 1 configuration. The boilers produce high pressure steam which is routed to the process for heating or to the steam turbine generators (STGs) for power generation and low pressure steam production.
  - The three (3) Essential 7.68 MW Essential Marine Diesel Generators (MDGs) providing power for black start operations and to bring the process to a safe condition during any major power upsets and supply essential power consumers in the event of a complete plant shutdown. These are offline during normal operations and have a sparing philosophy of 2+1.
  - The two (2) SOLAS designated Emergency Diesel Generators (EDGs) (1 x 1250 kW and 1 x 750 kW) which supply electricity to SOLAS critical equipment (e.g. control and safety systems, navigational aids, fire-fighting pumps, etc.). These are offline during normal operations.
  - Additional sources of internal combustion emissions over the life of the facility and field include accommodation support vessel(s) during maintenance shutdowns and additional vessel visits supporting these campaign events. These will occur periodically and result in additional emissions for the duration of the campaign.
- Combustion of hydrocarbons through the flare systems that will release atmospheric emissions. Sources include:
  - Warm Wet High-Pressure Flare (FWH Flare) (A-63001)
  - Cold Dry High-Pressure Flare (FDH Flare) (A-63002)
  - Cold Dry Low-Pressure Flare (FDL Flare) (A-63003)
  - Warm Wet Low-Pressure Flare (FWL Flare) (A-63004).
- AGRU Vent.
- Maintenance and Marine Vents.

[36] Nitrogen oxides (NO_X) emissions consist predominantly of nitrogen dioxide (NO_2) and nitrogen oxide (NO).

[37] Sulphur oxides refers to many types of sulphur and oxygen containing compounds such as SO, SO_2, SO_3, S_7O_2, S_6O_2, S_2O_2 (etc).

[38] PM_{10} refers to particulate matter emissions, particularly those with an aerodynamic diameter of less than 10 microns.

- Fugitive emissions to the atmosphere from FLNG equipment. Sources include vents on process vessels and tanks, breathers, valves, piping components, piping connections, analysers, instruments, HVAC systems, and switchgear and may occur during maintenance or whilst in operation.
- The additional air emissions from the accommodation vessel and broader turnaround activities are intermittent, temporary in duration and will comprise a minor and immaterial addition to the overall air emission profile for the Prelude FLNG and are therefore not assessed any further in this section.

During operations activities, most atmospheric emissions are emitted from the flare and power generation systems (see Table 9-74 and Figure 9-11) in the form of NOx, CO, and VOCs calculated using methodologies from the NPI Oil & Gas Emissions Estimation Handbook (2013). NO_x and CO are combustion by-products for the fuel gas that is used in these systems, and annual VOC loadings are a result of the factor applied and combustion efficiency.

Table 9-74 presents the actual air emissions, as reported via NPI from 2018 to 2025, and forecast emissions from 2026 to 2030 are presented in Table 9-75.

Table 9-74: Actual Air Emissions as reported to NPI 2018–2025

Source and Metric	Atmospheric Emissions Actuals (t/pa)							
	FY17/18	FY18/19	FY19/20	FY20/21	FY21/22	FY22/23	FY23/24	FY24/25
Steam Boiler (Fuel Gas)								
Approx. Fuel Consumption Rate (t/pa)	0	200,000	160,000	250,000	390,000	425,000	350,000	500,000
NO_2	0	594	565	938	1,424	1,557	1,267	1,836
SO_2	0	4	0.5	0.9	1.3	1.4	1.2	1.7
CO	0	182	80	133	201	220	179	260
PM	0	14	24	41	62	68	55	80
VOC	0	8	18	30	46	50	41	60
Steam Boiler (Diesel)								
Approx. Fuel Consumption Rate (t/pa)	66,313	50,000	19,000	27,000	10,000	10,000	20,000	2,700
NO_2	180	281	50	72	27	27	52	6
SO_2	1.2	1.2	0	0.5	0.2	0.2	0.4	0
CO	45.1	78.9	12	18	7	7	13	1.5
PM	11.2	2.4	0.5	3.7	1.4	1.4	2.7	0.3
VOC	1.8	1.8	0.5	0.7	0.3	0.3	0.5	0
Essential Diesel Generators								
Approx. Fuel Consumption Rate (t/pa)	2,621	500	3,500	1,000	2,400	450	3,000	650
NO_2	164	10	174	52	125	24	149	34
SO_2	0	4.8	0	0	0	0	0	0

Source and Metric	Atmospheric Emissions Actuals (t/pa)							
	FY17/18	FY18/19	FY19/20	FY20/21	FY21/22	FY22/23	FY23/24	FY24/25
CO	43.8	2.1	46	14	33	6.4	40	9
PM	10.2	0.3	5	1.6	4	0.8	4.6	1
VOC	4.1	0.2	4	1.3	3.1	0.6	3.7	0.9
Flaring								
Approx. Fuel Consumption Rate (t/pa)	4,705	600,000	300,000	150,000	100,000	130,000	80,000	40,000
NO_2	7	900	412	236	147	197	116	60
SO_2	0	0	0	4	5.5	1.4	7.8	3.9
CO	40.9	5,220	2,391	1,368	853	1,142	674	346
PM	0.6	33.6	16	9	6	8	4.7	2.4
VOC	70.5	9,000	4,122	2,358	1,471	1,969	1,163	596
Acid Gas Vent								
Approx. Fuel Consumption Rate (t/pa)	0	1,000	200,000	200,000	600,000	620,000	550,000	790,000
NO_2	0	0	0	0	0	0	0	0
SO_2	0	0	0	0	0	0	0	0
CO	0	0	0	0	0	0	0	0
PM	0	0	0	0	0	0	0	0
VOC	0	20	0	95	285	300	265	381
Fugitive Emissions								
Approx. Fuel Consumption Rate (t/pa)	0	100	200	200	40	412	1,500	1,500

Source and Metric	Atmospheric Emissions Actuals (t/pa)							
	FY17/18	FY18/19	FY19/20	FY20/21	FY21/22	FY22/23	FY23/24	FY24/25
NO_2	0	0	0	0	0	0	0	0
SO_2	0	0	0	0	0	0	0	0
CO	0	0	0	0	0	0	0	0
PM	0	0	0	0	0	0	0	0
VOC	0	100	37	43	9	88	275	356
Maintenance and Marine Vents								
Approx. Fuel Consumption Rate (t/pa)	-	-	-	2,000	3,500	1,500	3,000	3,000
NO_2	-	-	-	0	0	0	0	0
SO_2	-	-	-	0	0	0	0	0
CO	-	-	-	0	0	0	0	0
PM	-	-	-	0	0	0	0	0
VOC	-	-	-	230	270	170	600	647
TOTAL								
NO_2	351	1,785	1,201	1,298	1,723	1,805	1,584	1,936
SO_2	1.2	10	0.5	5.4	7	3	9.4	5.6
CO	129.8	5,483	2,529	1,533	1,094	1,375.4	906	616.5
PM	22	50.3	45.5	55.3	73.4	78.2	67	83.4
VOC	76	9,130	4,182	2,758	2,081	2,581	2,348	2,041

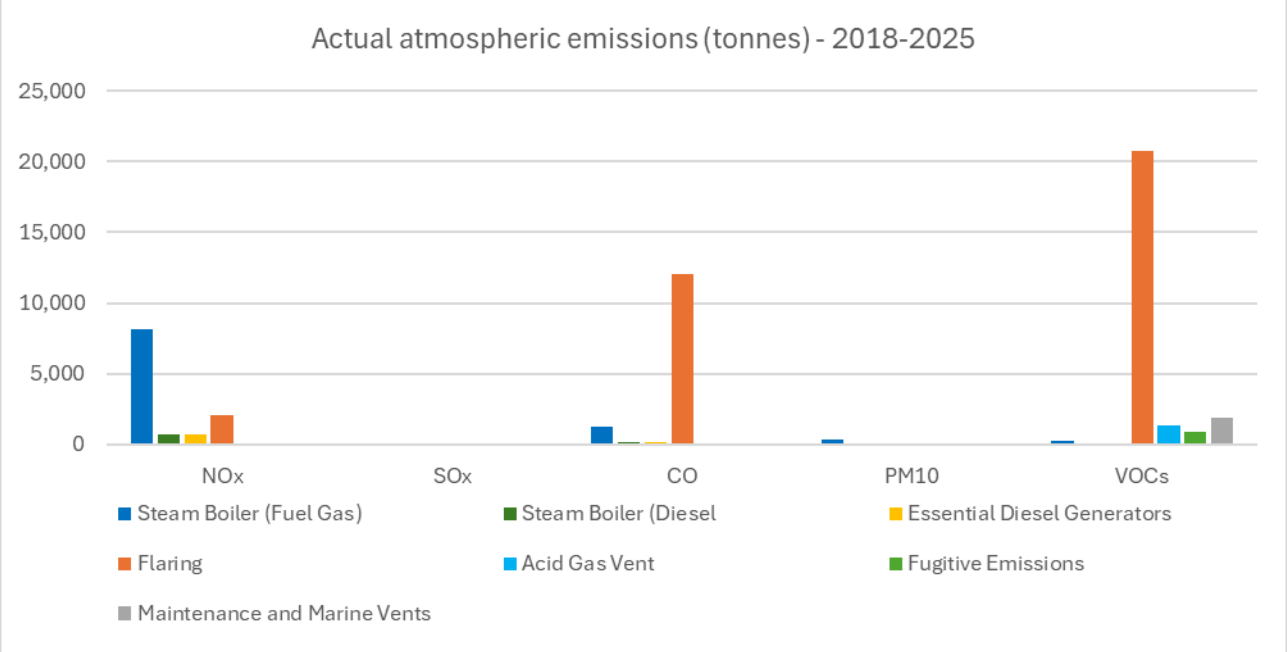


Figure 9-11: Actual Atmospheric Emissions by Emission Source (2018–2025)

Table 9-75 details the predicted of air emissions ranges which could be expected during 2026–2030.

Table 9-75: Forecast Air Emissions 2026–2030 (~t/pa) - includes Prelude and Crux

Emission Source	Approximate Fuel Consumption/Venting Rate 2026 – 2030	NO_2	SO_2	CO	PM	VOC
Steady State Combustion (Fuel Gas)	223,193–800,097[39]	821-2944	0.8-3	116-416	36-128	27-95
Non Steady State Combustion	11,874–25,321[40]	43-93	0.04-0.08	6-13	2-4	1-3
Flaring	13,787–48,024[41]	21-72	-	120-418	0.8-3	207-720
Acid Gas Vent	433,598–1,438,798[39]	-	-	-	-	217-719
Fugitive emissions (general leaks)	18,644 –38,773[39]	-	-	-	-	3,869–8,026

Results in Table 9-74 show clear changes in emissions relative to the improved reliability of the facility. For example emissions from fuel gas use on the steam boilers have seen an incremental increase as reliability has improved, whilst the reliance on diesel has significantly reduced. Similarly, improved reliability, increased production and higher CO_2 in the Crux gas sees a predicted increase in emissions from the AGRU vent (which is directly related to production) and a decrease in emissions from flaring. Forecast emissions in Table 9-75 show a similar pattern with the facility's improved reliability and increased production rates. It is noted that fugitive emissions are forecast to be higher than reported in previous years, this is due to several assumptions including that sources are from facility topside leaks, subsea and PW and that all emission are 100% methane.

[39] During normal operations and highest expected production year, the consumption/venting rate will be on the high side.

[40] During normal operations the consumption/venting rate will be on the low side.

[41] During normal operations and highest expected production year, the consumption/venting rate will be on the low side.

The inventory also indicates that emissions from the Prelude FLNG are comparable in magnitude to emissions from other oil and gas facilities, specifically the INPEX Ichthys FPSO (Inpex Browse Ltd 2008). Emissions from Prelude FLNG and the Ichthys FPSO and supporting marine vessels contribute to pollutant levels in the local marine environment airshed. The impacts of these combined emission sources on the air quality of the airshed has been examined in a screening air quality modelling study and is discussed in Section 9.11.2

The design standard pollutant concentrations for the steam boilers have been compared to actual emissions from stack testing results and are summarised in Table 9-76. Notably, the measured concentrations of NO_x and PM for boilers running on fuel gas were found to be well below the original design standards.

Table 9-76: Measured Emission Rates for the HP Steam Boilers at FLNG

Combustion Source	Average Dry Standard Stack Flow Rate per boiler (Nm^3/min)	Average Measured during Sep 2019 Stack Test	Design Standards or Predicted Design Levels[42]
Steam boilers A-40010 to A-40070 (running on fuel gas)	3,508	NO_x – 147 mg/Nm^3 SO_2 – 1.2 mg/Nm^3 PM – 3.3 mg/Nm^3	NO_x – 240 mg/Nm^3 SO_x – N/A[43] PM – 50 mg/Nm^3
Steam boilers A-40010 to A-40070 (running on diesel)	3,629	NO_x – 269 mg/Nm^3 SO_2 – 1.2 mg/Nm^3 PM – 2.3 mg/Nm^3	NO_x – Not applicable. SO_x – Fuel used shall be maximum 1,000 ppm PM – Not applicable

9.11.1.1 Mercury Emissions

The Mercury Removal Unit (MRU) on board removes virtually all elemental mercury from the feed gas, which is essential to protect the aluminium parts of the heat exchangers in the liquefaction section. Dry mercury free gas is then filtered before being sent to the NGL Extraction Unit and then used as the primary source of dry fuel gas for use in the boilers. Samples taken both upstream and downstream of the MRU between 2021 and 2023 found that no mercury was detected downstream of the MRU with inlet levels averaging 166 ug/Sm^3 (ranging from levels as low 8 to as high as 600 ug/Sm^3).

There remains however, three sources of mercury in air emissions as they are emitted prior to treatment through the MRU. These sources include:

- Fuel Gas: Emissions from fuel gas combustion due to the wet fuel gas component where continuous sources are from the Wet Fuel Gas Heater E-44006 and from the AGRU Flash Gas Vessel V-11003.
- Flare: Emissions from flare where continuous sources are from the purge supply if the flare in question is on fuel gas purge instead of nitrogen purge, and in the case of the LP Wet flare the continuous source is flash gas from the Produced Water Flash Gas vessel V-64031.
- Acid Gas Vent: Some elemental mercury will partition to the acid gas stream and will be vented via the Acid Gas Vent.

To estimate the mercury concentration in each of these streams of mercury partitioning study was undertaken. The study considered four cases that cover the range of the operating life of Prelude over the next 5-7 years including:

- Case 1: Prelude Only
- Case 2: Prelude/Crux Day 1
- Case 3: Crux Only

[42] Values sources from Prelude Environment Basis for Design 2000-110-G000-GE00-G00000-HX-7704-62001

[43] Meaning no project design specification was put in place for this parameter.

- Case 4: Prelude/Crux End of Plateau (EOP)

Additional sensitivity cases were also include to address the following scenarios:

- Sensitivity 1: Crux pipeline packing and MEG injection during Case 2 Prelude/Crux Day 1.
- Intent: Determine if cold Crux arrival temperatures impact mercury emissions. Determine how presence of MEG impacts mercury emissions as MEG increases the solubility of mercury in water.
- Sensitivity 2: Wet fuel gas supply from V-10007 instead of V-10006 for Case 1 Today.
- Intent: Determine if wet fuel gas supply location impacts steady state mercury emissions.
- Sensitivity 3: Higher partitioning fraction to flash gas separator V-11003 flash gas.

9.11.1.1.1 Wet Fuel Gas

Prelude fuel gas can be supplied from upstream of the MRU ("Wet Fuel Gas") or downstream of the MRU ("Dry Fuel Gas"). Normally, the primary sources for fuel gas are all downstream of the MRU and therefore contain no mercury, however a minimum flow of 180tpd of wet fuel gas is always supplied from Wet Fuel Gas to keep the wet fuel gas heater E-44006 online to ensure that fuel gas supply can be maintained in the event of a cold-end or AGRU trip. This results in the total fuel gas flow having a mercury concentration in the range of 60-85 ug/Sm^3 (Table 9-77). Depending on actual partitioning in the AGRU solvent system the mercury concentration in total fuel gas could be almost double (i.e. range from 106-144 ug/Sm^3 rather than 61-84 ug/Sm^3) (Table 9-77, Case 1.3). These levels, however, remain well below the maximum point source target of 200 µg/Sm^3 defined under the Protection of the Environment Operations (Clean Air) Regulation 2022 (NSW) (refer to Section 9.11.2.1).

During upset conditions such as cold-end / AGRU trips or restart from shutdown, all fuel gas will be supplied from wet fuel gas until dry fuel gas flow is established. During such transient scenarios, the fuel gas mercury concentration will not be equivalent to the concentration of the wet fuel gas in Table 9-77, as this concentration is heightened in 'steady state' due to the flash gas from V-11003 which is a very small flow. The wet fuel gas mercury concentration during transient modes will be similar to the C-11001 feed gas concentrations (Table 9-77).

Table 9-77: Predicted Mercury in Fuel Gas

Process Area	Description	Case	Total Mass Flow, kg/h	Hg Conc. (ug/Sm^3)	Hg Partitioning (mass% of inlet Hg)	Hg Yearly Rate (kg/yr)*
FUEL GAS	Total Wet Fuel Gas (from V-10006 and V-11003)#	1 Prelude Only	10082	413	3.89%	36.3
		2 Crux Day 1	11852	494	3.14%	50.5
		3 Crux Only	10647	387	2.68%	37.3
		4 Prelude/Crux EOP	11839	523	3.01%	54.1
		2.1 Cold with MEG	11845	409	2.60%	41.8
		1.2 V-10007 WFG	10082	404	3.81%	35.6
FUEL GAS	Fuel Gas to Boilers	1 Prelude Only	49525	62	3.85%	35.9
		2 Crux Day 1	59942	79	3.11%	50.1
		3 Crux Only	49525	68	2.66%	36.9
		4 Prelude/Crux EOP	59943	84	2.99%	53.6
		2.1 Cold with MEG	59942	66	2.58%	41.5
		1.2 V-10007 WFG	49525	61	3.78%	35.3
		1.3 Prelude Only High Hg in Flash Gas	-	106	6.7%	62.2
		1 Prelude Only	546360	161	86.81%	810.2

Process Area	Description	Case	Total Mass Flow, kg/h	Hg Conc. (ug/Sm^3)	Hg Partitioning (mass% of inlet Hg)	Hg Yearly Rate (kg/yr)*
U11000 ABSORPTION	Feed Gas to C-11001	2 Crux Day 1	786246	151	69.85%	1124.1
		3 Crux Only	550860	141	55.33%	769.5
		4 Prelude/Crux EOP	773174	161	67.22%	1206.1
		2.1 Cold with MEG	784849	125	57.88%	931.5
		1.2 V-10007 WFG	546370	161	86.89%	811.1

* Yearly figures assume 100% utilisation (i.e. 365 days per year operation).
# Wet fuel gas is the combined gas from flash gas separator V-11003 and from V-10006 via the wet fuel gas heater.

9.11.1.1.2 Acid Gas Vent

The model predicts mercury concentration in the range of 44-63ug/Sm^3 in the acid gas vent (Table 9-78), although there is a high degree of uncertainty due to unknown parameters with regards to the solubility of mercury in amine. A sensitivity case was checked for Case 1 (Prelude only) to determine what the impact would be if 90% of the mercury arriving to the flash gas vessel V-11003 partitioned to the flash gas in line, with results indicating that the mercury concentration in the acid gas vent would decrease from 63 to 11 ug/Sm^3. It is therefore possible that the mercury concentration in the acid gas vent could be six times lower (i.e. range from 7-11ug/Sm^3 rather than 44-63ug/Sm^3) depending on actual partitioning in the AGRU solvent system.

The Crux cases show lower mercury in the acid gas vent. This is due to more mercury partitioning into the condensate phase owing to Crux's cold arrival temperatures.

Table 9-78: Predicted Mercury in the Acid Gas Vent (AGRU)

Process Area	Description	Case	Total Mass Flow, kg/h	Hg Conc. (ug/Sm^3)	Hg Partitioning (mass% of inlet Hg)	Hg Yearly Rate (kg/yr)
U11000 REGENERATION	Acid Gas Vent	1 Prelude Only	100334	63	3.38%	31.6
		2 Crux Day 1	161283	53	2.67%	43.0
		3 Crux Only	129545	44	2.03%	28.2
		4 Prelude/Crux EOP	169277	54	2.52%	45.3
		2.1 Cold with MEG	161276	44	2.21%	35.6
		1.2 V-10007 WFG	100327	63	3.39%	31.6
		1.3 Prelude Only High Hg in Flash Gas	-	11	0.6%	5.7

9.11.1.1.3 Flare

During steady state operation, Prelude is designed to use N_2 as the purge flow on all other flares. However for the purpose of the partitioning study it was assumed that all the flares are on fuel gas purge. As purge gas is supplied from fuel gas the mercury concentration in the FDL, FDH, and FWH is in line with the fuel gas mercury concentration as shown in Table 9-79.

The FWL has a higher concentration since off-gas from the produced water flash gas vessel V-64031 is continuously routed to FWL. In Case 3 with Crux Only production, the concentration of mercury in FWL is significantly lower than other cases due to very little off-gas being generated in V-64031 since there is almost no aqueous phase.

During upset scenarios such as blowdown or shutdown/restart flaring, the FDL and FDH are expected to have negligible mercury concentrations as the sources are all downstream of the MRU. The FWL mercury concentration is likely to be lower than steady state, but higher volumes. The FWH will have mercury concentrations in the same order of magnitude as the total feed to V-10006 (Table 9-80).

Table 9-79: Predicted Mercury in Flare Streams

Process Area	Description	Case	Total Mass Flow, kg/h	Hg Conc. (ug/Sm^3)	Hg Partitioning (mass% of inlet Hg)	Hg Yearly Rate (kg/yr)
FLARE	Total FWL	1 Prelude Only	171	342	0.07%	0.6
		2 Crux Day 1	179	681	0.07%	1.1
		3 Crux Only	131	95	0.01%	0.1
		4 Prelude/Crux EOP	205	1046	0.11%	1.9
		2.1 Cold with MEG	182	985	0.10%	1.7
		1.2 V-10007 WFG	171	341	0.07%	0.6
FLARE	Purge to FWH	1 Prelude Only	115	62	0.01%	0.1
		2 Crux Day 1	115	79	0.01%	0.1
		3 Crux Only	115	68	0.01%	0.1
		4 Prelude/Crux EOP	115	84	0.01%	0.1
		2.1 Cold with MEG	115	66	0.00%	0.1
		1.2 V-10007 WFG	115	61	0.01%	0.1
FLARE	Purge to FDH	1 Prelude Only	115	62	0.01%	0.1
		2 Crux Day 1	115	79	0.01%	0.1
		3 Crux Only	115	68	0.01%	0.1
		4 Prelude/Crux EOP	115	84	0.01%	0.1
		2.1 Cold with MEG	115	66	0.00%	0.1
		1.2 V-10007 WFG	115	61	0.01%	0.1
FLARE	Purge to FDL	1 Prelude Only	115	62	0.01%	0.1
		2 Crux Day 1	115	79	0.01%	0.1
		3 Crux Only	115	68	0.01%	0.1
		4 Prelude/Crux EOP	115	84	0.01%	0.1
		2.1 Cold with MEG	115	66	0.00%	0.1
		1.2 V-10007 WFG	115	61	0.01%	0.1

Table 9-80 Predicted Mercury in Feed to C-11001

Process Area	Description	Case	Total Mass Flow, kg/h	Hg Conc. (ug/Sm^3)	Hg Partitioning (mass% of inlet Hg)	Hg Yearly Rate (kg/yr)
AGR FEED SEPARATOR	Total Feed to V-10006	1 Prelude Only	556177	162	88.89%	829.6
		2 Crux Day 1	793933	151	70.52%	1134.9
		3 Crux Only	558360	141	56.09%	779.9
		4 Prelude/Crux EOP	780965	161	67.87%	1217.8
		2.1 Cold with MEG	792534	125	58.44%	940.5
		1.2 V-10007 WFG	548674	162	87.78%	819.4

9.11.1.2 Occupational Health and Safety Air Quality Management

In February 2025 Shell was issued with an Occupational Health and Safety (OHS) Improvement Notice from NOPSEMA, in relation to air quality and odour issues on Prelude, specifically related to benzene and hydrogen sulphide (H_2S). Improving air quality on Prelude is a major focus of the facility with numerous actions already taken which have shown measured improvements in air quality and further long term improvement projects are planned.

The management of these air quality issues is specifically related to personnel exposure and is not relevant to the environmental impacts as covered by this Environment Plan. However, as part of the management of air quality from an occupational health and safety perspective, monitoring of air quality parameters has been conducted at various sources of air emissions across the facility and air measurement units have been installed on three levels of the Living Quarters to measure air quality data including BTEX, H_2S, NO_2, and total VOC, on a continuous live basis. To date benzene levels have been less than 50% of the occupational exposure standard of 0.25ppm and no significant levels of H_2S that could result in harmful impacts, either in the short or long term have been recorded. Similarly NO_2 and VOC levels have all been below occupational exposure levels.

9.11.2 Description and Evaluation of Impacts

Table 9-81 identifies the environmental features and values and sensitivities potentially affected by atmospheric emissions that may result from the activities covered by this EP, with further evaluation of the impacts and/or risks to physical values and sensitives (including cumulative impacts) provided in Sections 9.11.2.1 and 9.11.2.2. Features, protected areas or values and sensitivities which could not be credibly affected by atmospheric emissions are not discussed further.

Table 9-81: Atmospheric Emissions Receptor Impact Screening Summary

	Protected Areas			Features														Values and Sensitivities																										
				Physical		Natural				Socioeconomic							Heritage and Cultural			Physical				Natural								Socioeconomic							Heritage and Cultural						
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect																					×																						

Legend:		
		Potentially affected
	×	Predicted impact

9.11.2.1 Physical Values and Sensitivities: Air Quality

Other operational offshore facilities exist within the region of the Activity Area, including the, the Ichthys Offshore Facilities (~17 km), the Montara FPSO (~188 km) and the Crux Platform (165 km). Based on public reporting under the NPI scheme published on the DCCEEW website, these regional facilities produce similar or lower annual emission loadings into the atmosphere (Table 9-82). For the 2023/2024 NPI reporting period, the activity as a percentage contributed less than 50% of the regional loading for NOx, CO and VOCs, and approximately 70% for PM_{10} and SO_x (Table 9-82).

Table 9-82: Regional Facility Annual NPI Emissions

Equipment	NOx	CO	PM_{10}	VOC	SO_x
NPI Tonnes Reported 2023/2024					
Prelude FLNG[44]	1600	910	67	2100	9.4
Montara FPSO[45]	310	280	4.8	390	0.5
Ichthys Offshore Facility[46]	1400	920	24	1300	3
Crux Facility[37]	100	211	2	474	0.24
Regional Loading (Total)	3410	2321	97.8	4264	13.4
Estimated Activity NPI Contribution					
Prelude Airshed Contribution (%)	47%	40%	68%	49%	70%

NEPM Standards

The NEPM Ambient Air Quality Guidelines specify 0.015ppm as an annual average and 0.08ppm on an hourly average for NO_2 emissions (there are no limits for NO_x or NO, only for NO_2). A screening level air dispersion modelling assessment for NO_X, SO_2, $PM_{2.5}$, CO and VOC emissions was undertaken for the Prelude FLNG facility based on a conservative approach using the US EPA SCREEN3 model. Maximum predicted ground-level concentrations were predicted at distances of 17 km and 40 km from the Prelude FLNG representing the locations of the nearby Ichthys FPSO facility and Browse Island respectively, and compared to the Australian Ambient Air Quality Standards (AAQS)[47] for NO_2, SO_2, $PM_{2.5}$ and CO. As the AAQS does not list criteria for VOC, VOC results were compared against criteria referenced in Oman Air Quality Protection Note (AQP)[48]. The modelling results for normal operations (Table 9-83) indicate that ground-level concentrations of NO_2, SO_2, $PM_{2.5}$,CO and VOC at the nearest sensitive receptors are predicted to be well below the AAQS and AQP Note. As a result, ambient air quality impacts associated with the Prelude FLNG facility are concluded to be of low magnitude.

Table 9-83: Normal Operations Maximum Predicted Concentrations

		FPSO (17 km)		Browse Island (40 km)		AAQS/AQP Note	
		(ppm)	($\mu g/m^3$)	(ppm)	($\mu g/m^3$)	(ppm)	($\mu g/m^3$)
NO_2	1hr	0.002	5.0	0.002	3.60	0.15	246
	Annual	-	0.4	-	0.29	0.08	62

[44] Prelude FLNG Individual report emissions (npi.gov.au)

[45] Montara FPSO Individual report emissions (npi.gov.au)

[46] Ichthys Offshore Facility Individual report emissions (npi.gov.au)

[47] National Environment Protection Measure for Ambient Air Quality (the 'Air NEPM'). Australian Department of the Environment.

[48] Air Quality Protection Technical Note: https://www.duqm.gov.om/upload/files/air-quality-protection.pdf

		FPSO (17 km)		Browse Island (40 km)		AAQS/AQP Note	
		(ppm)	(µg/m^3)	(ppm)	(µg/m^3)	(ppm)	(µg/m^3)
$PM_{2.5}$	24hr	-	-	-	-	-	25
	Annual	-	-	-	-	-	8
CO	8hr	-	0.02	-	0.01	9	-
VOC	3hr	-	0.001	-	0.001	0.24	160

Visual Amenity (Smoky Flare)

Smoke is visible from flares when flared C2+ gasses crack and do not burn during gas combustion at the flare tip. This can be reduced or in some cases (specific compositions and/or flows) eliminated by increasing oxygen mixing in the flame or cooling of the flame by injecting "assist gas" at the flare tip. On Prelude steam is used to achieve this on the HP wet and dry flares, as well as the LP wet flare, but is not required on the LP dry flare as the flared gas is primarily C1 (methane).

Operational experience and vendor data indicate that at the highest flare combustion efficiency (lowest formation of VOC and particulate), the flare is still not completely smokeless. The use of additional steam will result in a smokeless flare, but with lower overall combustion efficiency and hence greater CO and unburned hydrocarbon emissions. Additionally, the production of more steam requires more fuel being burnt in the boilers and therefore an increase in air and GHG emissions.

During normal operation, where there is very little flaring, this gas is primarily methane or at a low enough flow that there is sufficient oxygen mixing at the tip and therefore no benefit from steam injection. It has been found that at low steam injection rates, condensation can occur which may cause issues with the flare pilots, leading to a risk of cold venting. During maximum flaring rates, such as an emergency shutdown, the flare tip steam injection system is not designed for smokeless burning.

Apart from the aesthetic impact associated with a slightly smoky flare, there would be no material environmental impacts to local and regional airshed quality. In terms of health impacts, a Flare Flame-Out and Venting Atmospheric Dispersion Study (Shell 2013) was carried out to assess the extent of hazards associated with gas dispersion with regards to flammable and toxic risks from the flare sources. The study confirmed that the height and position for each flare was a suitably safe distance to work places and the living quarters to avoid any flammable, acute toxic or chronic exposure impacts at the facility.

Mercury Point Source Concentrations

Mercury is not a regulated substance under the National Environment Protection (Ambient Air Quality) Measure or National Environment Protection (Air Toxics) Measure. These guidelines aim to minimise the impact of air emissions from industrial activities on the environment. Safe Work Australia sets Workplace Exposure Standards (WES) for airborne contaminants for occupational exposure, including mercury. These standards aim to minimise the impact of mercury emissions from industrial activities. These have been developed to protect against acute and chronic human exposure.

Not all Australian jurisdictions have standards for emissions from point sources such as those from the flare and power generation exhaust. However, the Protection of the Environment Operations (Clean Air) Regulation 2022 (NSW) is generally the most comprehensive state-based legislation and often applied to projects throughout all Australian jurisdictions. For the most stringent Group 6 criteria, this legislation includes a maximum point source concentration target of 0.2 mg/m^3 (200 µg/Sm^3).

As the majority of fuel gas on Prelude is treated through the MRU before use, the mercury concentration in the exhaust gas prior to atmospheric dispersion, including sources which are not treated through the MRU (Section 9.11.1.1), are already significantly lower than the Group 6-point source concentration target for exhaust flue gases (200 µg/Sm^3).

Cumulative Impacts

A cumulative screening assessment for the Prelude FLNG facility in combination with the Ichthys offshore facility with Browse Island as receptor has also been undertaken. In order to combine the concentrations from

Prelude and Ichthys, it was conservatively assumed that Ichthys is located 17 km downwind and in the direct trajectory between Prelude and Browse Island. The cumulative maximum predicted concentrations under normal operating conditions predicted at Browse Island are provided in Table 9-84. The results show that the maximum predicted concentrations at the identified receptor are well below the associated ambient air quality standards.

Table 9-84: Cumulative Prelude and Ichthys Normal Operations Maximum Predicted Concentrations

Parameter		Browse Island (40 km)		AAQS	
		(ppm)	(µg/m^3)	(ppm)	(µg/m^3)
NO_2	1hr	0.024	49.20	0.15	246
	Annual	0.002	3.94	0.08	62
SO_2	1hr	-	0.14	0.2	571
	24hr	-	0.06	0.08	228
	Annual	-	0.01	0.02	57
$PM_{2.5}$	24hr	-	-	-	25
	Annual	-	-	-	8
CO	8hr	0.03	35.91	9	-
VOC	3hr	0.003	8.75	0.24	160

9.11.2.2 Cumulative Impacts of Crux Processing on Prelude FLNG

The indirect processing of Crux molecules by Prelude FLNG is not expected to significantly change the trajectory emissions profile on Prelude FLNG (see Table 9-75) as Crux production is progressively replacing ullage in Prelude production (not adding to Prelude production) and therefore demand for power by utilities is not being increased.

9.11.2.3 Summary

The quantities of gaseous emissions associated with the Activities are relatively small and will, under normal circumstances, be quickly dissipated into the surrounding atmosphere through natural dispersion and dilution (e.g. wind, mixing). In general terms, the sensitivity of local air quality in the Activity Area is considered low due to the absence of existing pollution sources and the absence of sensitive receptors. Considering the location of the Activity Area in the open ocean, which is well-removed from nearest residential or sensitive populations of the WA coast (~200 km offshore), and the localised nature of the emissions, it is considered highly unlikely that atmospheric emissions will result in significant impacts to ambient air quality at a local and regional scale.

Furthermore, no impacts to the local airshed at the nearest shoreline of Browse Island (~40 km from Prelude) which supports foraging and breeding populations of turtles and birds, are expected given the localised nature of the emissions. Atmospheric emissions will result in only minor deterioration in local air quality for transient bird species passing through the Activity Area. Sixteen threatened and/or migratory seabirds were identified as potentially occurring within, or having habitat potentially transiting through the Activity Area, these species may be impacted by temporary and short-term deterioration in air quality if they are transiting the immediate area of the FLNG and vessel exhaust release points. The potential impacts to these receptors from emissions are considered negligible due to the low magnitude of emissions and remote location. The potential for black smoke resulting from emissions may impact visual amenity, however, no impacts to visual amenity for residential communities and tourism activities are expected.

Given the offshore remote context, and the low volumes of atmospheric emissions that will be generated, environmental sensitivities that may be impacted by atmospheric emissions include only physical features (air quality). No impacts to protected areas, natural features, socioeconomic features, heritage and cultural features, physical values and sensitivities, natural values and sensitivities, socioeconomic values and

sensitivities, or heritage and cultural sensitivities are predicted or reasonably foreseeable. NEPM standards at the nearest populated areas are unlikely to be exceeded.

Potential impact consequence from atmospheric emissions are assessed as Slight (Magnitude: −1; Sensitivity: L).

9.11.3 Impact Assessment Summary

Table 9-85 lists the residual impact consequence ranking of the relevant environmental receptor groups.

Table 9-85: Atmospheric Pollutant and Air Toxics Emissions Evaluation of Residual Impacts

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Evaluation – Planned Impacts			
Protected Areas	N/A	N/A	N/A
Physical Features	N/A	N/A	N/A
Physical Values and Sensitivities	–1	L	Slight
Natural Features	N/A	N/A	N/A
Natural Values and Sensitivities	N/A	N/A	N/A
Socio-Economic Features	N/A	N/A	N/A
Socioeconomic Values and Sensitivities	N/A	N/A	N/A
Heritage and Cultural Features	N/A	N/A	N/A
Heritage and Cultural Values and Sensitivities	N/A	N/A	N/A

9.11.4 ALARP Assessment and Environmental Performance Standards

Table 9-86: Atmospheric Emissions - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	Use of renewable energy (e.g. solar, wind and wave) in lieu of fossil fuels for power generation and marine vessel propulsion.	No	Use of solar, wind or wave energy for a continuously running operation does not have the required reliability and will also require additional space and capital investment which are not justified. Use of renewable technology for a complete offshore LNG processing facility is not yet technologically proven and therefore not available.	N/A	N/A	N/A
Elimination	Recover the VOC emissions displaced during condensate loading and reuse in the process.	No	VOC emissions during condensate loading cannot be eliminated as this would require an additional complex installation to separate hydrocarbons from inert gas, possibly liquefy them and compress them to reuse in the process. This would lead to additional space requirements at the facility, congestion and sources of fugitive emissions for an infrequent operation (condensate loading occurs once in a fortnight), which are disproportionate compared to any reduction in VOC emissions. This option is therefore not considered to be ALARP.	N/A	N/A	N/A
Substitution	Use of electric motor drivers or aero-derivative GTs	No	As part of the FLNG feasibility studies for Prelude a number of power generation options were considered. As part of this assessment of options, gas turbines were rejected as the risk of a gas turbine blade failure was considered too high to allow operation of gas turbines above LNG tanks. Electric drivers were also rejected as the footprint required was significant and required the use of 66kV distribution which is not approved for marine use by the IMO. Combined cycle was also considered but was not found to be sufficiently electrically stable, particularly in upset and start-up conditions. This lack of stability would have resulted in lost production and extended flaring leading to more atmospheric pollutant and GHG emissions. Thereby negating the energy efficiency benefits achieved through the application of gas turbines. Steam turbines were the option selected. Seven steam boilers generate sufficient steam to drive the main compressors and supply 120 MW. While less energy efficient, resulting in an 8% fuel use increase, it is a more robust and reliable option in terms of equipment reliability. The complexity, large footprint required, and the significant impact to production that would be required to retrofit the system at this stage of operations is considered to be grossly disproportionate to any reduction in emissions that might be realised from less fuel gas use, and is therefore not ALARP.	N/A	N/A	N/A
Engineering	Use of end of stack technology (e.g. scrubbers or filters) to clean the exhaust gas of nitrogen oxides or particulate matter.	No	End of stack technology is not an efficient way to minimise emissions due to additional material, limited space, and labour requirements to maintain scrubbers or filters in working condition. Additional safety and operability hazards and the generation of solid waste would like be disproportionate to any environmental benefits realised as a result of this technology. Furthermore, modelling (Section 9.11.2) indicates that air quality from releases of exhaust gas will not exceed the AAQS criteria at the nearest receptors.	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Engineering	Inject steam into the flare system in order to reduce smoky appearance.	No	A flare steam injection system is designed and installed on Prelude FLNG. Steam is provided to the high pressure dry and wet flares and the low pressure wet flare to primarily cool the flare tips and prevent thermal cracking. Operational experience and vendor data indicate that at the highest flare combustion efficiency (lowest formation of VOC and particulate), the flare is still not completely smokeless. Additional steam injection can result in a smokeless but less efficient flare, thus emitting more uncombusted fuel gas as well as additional GHG emissions from the process of producing more steam. The steam injection to the flare will prioritise flare integrity and GHG optimization over air pollutant reduction. An overall improved environmental outcome is achieved following this approach due to the limited effect of air emissions on local and regional receptors and benefit from reducing GHG emissions using this approach.	N/A	N/A	N/A
Engineering	Flaring or incineration of the acid gas stream to oxidise H_2S and the residual hydrocarbons in the gas including methane and BTEX.	No	As the acid gas stream consists of more than 98% CO_2, to oxidise and render the hazardous components of the stream (i.e. H_2S, BTEX, PAH and CH_4) non-hazardous, it will be required to enrich the acid gas with large volumes of hydrocarbons in order to raise the calorific value of the gas and burn it. This will lead to emissions of other pollutants (NO_x, SO_x, PM, CO) and more GHG emissions to atmosphere and the installation of a more complex system to operate on the facility in comparison to a vent stack.	N/A	N/A	N/A
Engineering	Operation of the Mercury Removal Unit (MRU) to remove mercury in the fuel gas.	Yes	The Mercury Removal Unit (MRU) on Prelude removes virtually all elemental mercury from the feed gas to the liquefaction facilities, which is essential to protect the aluminium parts of the heat exchangers in the liquefaction section. Dry mercury free gas is then filtered before being sent to the NGL Extraction Unit and then used as the primary source of dry fuel gas for use in the boilers. Samples taken both upstream and downstream of the MRU between 2021 and 2023 found that no mercury was detected downstream of the MRU with inlet levels averaging 166 ug/Sm^3 (ranging from levels as low 8 to as high as 600 ug/Sm^3). There remains however, three sources of mercury in air emissions as they are emitted prior to treatment through the MRU. A mercury partitioning study was undertaken to estimate the expected mercury concentration in these air emissions at Prelude FLNG, including with the processing of Crux gas, with results detailed below and in Section 9.11.1.1. • **Flare:** Prelude is currently using fuel gas for the purge flow on the LP Wet Flare (FWL), whilst all other flares are on N2 purge. Based on data from the partitioning study the expected mercury concentrations from the LP wet flare are minimal (<2 kg/yr). The contribution from other flares, if fuel gas purge is required, is also minimal (<0.1 kg/yr per flare header). Existing controls to maintain the flare headers on N_2 purge when possible is considered ALARP and acceptable to manage these emissions. • **Wet Fuel Gas:** Prelude fuel gas can be supplied from upstream of the MRU or downstream of the MRU. A minimum flow of 180tpd of wet fuel gas is always supplied from Wet Fuel Gas to keep the wet fuel gas heater E-44006 online to ensure that fuel gas supply to the boilers can be maintained in the event of a cold-end or AGRU trip. The addition of the minimum flow of 180tpd of	9.1	The MRU is categorised as an ECE and is prioritised, maintained and confirmed to be functioning in accordance with the CMMS.	MRU CMMS maintenance records.
				9.2	Complete a feasibility study and ALARP review by the end of Q1 2027 on available measures to minimise the quantity of mercury in the continuous wet fuel gas supply. Measures identified as feasible and ALARP will be implemented as soon as practicable, as appropriate to the complexity of the measure.	Copy of feasibility study and ALARP review report. Evidence of planned and implemented mercury reduction measures.
				9.3	Complete a feasibility study and ALARP review by the end of Q1 2027 to assess the possible installation of a mercury removal unit upstream of any fuel, flare, or acid gas vent points (upstream of the current MRU location). If assessed as feasible and ALARP install the MRU during the next practicable TA opportunity.	Copy of feasibility study and ALARP review report. If assessed as feasible and ALARP evidence that the project has been added to the scope for the next TA opportunity.
				9.4	Following 12 months of supply of Crux gas re-assess the mercury partitioning model to validate the assumptions. If results indicate greater than expected mercury partitioning, and installation of an upstream MRU (as per EPS 9.3) has not been committed to, this will trigger an investigation into the source of the increase and a re-assessment of the study in EPS 9.3, including a screening of other available options, taking into account the principles of ALARP.	Note for File (or similar) documenting the re-assessment of the mercury partitioning assumptions.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			wet fuel gas results in the total fuel gas flow having a mercury concentration in the range of 60-85 ug/Sm^3. A feasibility study to look at measures to minimise the quantity of mercury in continuous wet fuel gas supply will be undertaken (see EPS 9.2) Any measures identified to minimise mercury in the continuous wet fuel gas streams would also minimise mercury in flare streams when fuel gas purge is in use. Shell commit to the implementation of any measures deemed feasible and ALARP as soon as practicable, given any process constraints and/or complexities. It is noted that some measures may be simple process changes which can be implemented immediately, whilst other measures may require equipment modifications which would require additional planning and implementation time. • **AGRU Vent:** The model predicts mercury concentration in the range of 44-63ug/Sm^3 in the AGRU vent, however there is a high degree of uncertainty with the parameters for solubility of mercury in amine. As a result of this uncertainty the mercury concentration in acid gas vent could be six times lower (i.e. range from 7-11ug/Sm^3 rather than 44-63ug/Sm^3) depending on actual partitioning in the AGRU solvent system. Elimination of mercury in all air emissions at Prelude would require the installation of a new mercury removal unit upstream of any fuel, flare, or acid gas vent points meaning upstream of the current MRU location. Whilst this is a technically feasible solution, there are major practical constraints with such a solution on Prelude due to limited space and the near-atmospheric operating pressure of the streams and consequent large volume flow of gas. A detailed feasibility assessment and ALARP review (EPS 9.3) is required to further assess this option. If determined to be feasible and ALARP, such a project would be expected to take an estimated 3-4 years from a decision being made to implementation of the project, and would require a TA for installation. The principles of ALARP will be adhered to in any studies and reviews, as there are unknown future variables relating to availability of technology; utilities required to operate technology; cost (design, construct, install) and interrelationships and trade-offs with waste/health/hygiene; safety, operability and maintainability - all of which will influence the assessment of gross proportionality. Assessment of gross proportionality will be visible in the committed reviews as part of the principles of ALARP assessment. Mercury is known to be particularly difficult to accurately sample and analyse with the accuracy and reproducibility of analytical results dependent on: • Production rates and ability to operate at steady states – experience and data available to date indicates that we can measure mercury content more accurately at higher production rates and when the plant is steady for an extended period. • Suitable sample points and sample containers for mercury analyses – sample point design and sampling equipment must be appropriate for the level of mercury expected in the stream • Expected mercury concentration – different sample collection methods are used depending on expected mercury concentrations Suitable sample points and analytical methods are available on Prelude for sampling of mercury content at the inlet and the outlet of			

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			the MRU, however validation of the partitioning study with sampling is currently not possible for the three streams referenced above due to the lack of suitable sampling points at the required locations. To validate the assumptions of the mercury partitioning study, a re-assessment will be conducted following the first 12 months of Crux operations. If results indicate greater than expected mercury partitioning, and installation of an upstream MRU (as per EPS 9.3) has not been committed to, this will trigger an investigation into the source of the increase, and a re-assessment of the study in EPS 9.3, including a screening of other available options, taking into account the principles of ALARP.			
Engineering	Flare flow meters and CMMS as detailed in Section 10.5.8 and 10.5.9.	Yes	Flare flow meters, an equipment control measure, are maintained according to the maintenance schedule and maintenance system to meet reliability, availability, and accuracy requirements.	10.1	Flare flow meters are categorised as ECEs, and are prioritised, maintained and confirmed to be functional in accordance with the CMMS.	Flare flow meter CMMS maintenance records.
Engineering, Administrative and Procedural	Optimised operation of the power generation systems to minimise GHG emissions including: • The use of dual fuel HP Steam boilers which are operated on fuel gas during steady state production operations. • A surveillance program and DCS logic in place to monitor the boilers such that they are operating safely and reliably. • Work Execution Flow Scheme (WEFS) to assist with optimising start-up activities. • Daily connects between panel operators and surveillance engineers. • Daily Surveillance Review (DSR) and Daily Production Review (DPR) meetings. • Fuel and Flare Forum to minimise fuel demand and reduce emissions. • Maintenance of the system in accordance with CMMS as defined in Section 10.5.8 and 10.5.9	Yes	Fuel gas produced at Prelude, is a cleaner burning fuel in comparison to diesel and will be preferentially used during normal operations. The use of low sulphur diesel will be required only during occasional shutdown and start-up scenarios and safety function testing. Seven boilers are installed, with one ideally available as a spare. This ensures that boilers can be operated within their optimal efficiency range, avoiding inefficient, high-emission operation and unnecessary start-ups/shutdowns. Operating the boiler system within the design operating envelope and at the targeted/design efficiency provides a degree of assurance that the emission levels are within the levels guaranteed by the vendor of the equipment. Parameters monitored include: • Type of fuel used – fuel gas or low sulphur diesel. • Fuel to steam ratio – design rate of 13.5 tonnes steam / tonne of fuel gas. • Air flow – air flow is dynamically controlled via maintaining an excess O_2 set point. This is cascaded via boiler-firing controls in the DCS which also compensate for the number of burners and lead-lag of the boiler (through ramp-up and ramp-down). Flow is controlled via the actuation of the force draft fan dampers. • Flue gas temperature – design temperature limit is 250ºC to manage equipment integrity and operating target of 210 ºC for energy efficiency. • Excess O2 – to improve energy efficiency the excess O2 is dynamically changed according to boiler load based on DCS logic. The continuous monitoring and surveillance of the above parameters with supporting set-points and DCS logic, ensures that operation of the boiler system is within the most reliable and safe operating mode, which in turn increases reliability and reduces emissions. The monitoring also allows for rapid detection and response to deviations, and prevents and/or minimises abnormal events (such as unplanned flaring or venting) that could significantly increase GHG output. Daily connects between the panel operators and the Surveillance Engineers are used to review performance and discuss and implement minor adjustments to ensure that the boilers are operating	9.5	HP Steam boilers to operate on fuel gas during steady state production operations, or on low sulphur diesel as required.	DCS shows boilers operated using fuel gas.
				9.6	A surveillance program and DCS logic is in place for the boilers and power generation units to monitor and optimise the following parameters: • Excess O_2 • Flue gas temperature • Fuel to steam ratio • Air flow (or fan speed)	DCS/PI trends/data of the following parameters: • Excess O_2 • Flue gas temperature • Fuel to steam ratio • Air flow (or fan speed)
				9.7	Daily connects occur between the Panel Operator and the Surveillance Engineer where minor adjustments are made to ensure that the boilers are operating as safely and reliably as possible. Further detailed monitoring and any actions to improve the safe and reliable operation of the boilers are identified in the DSR and are planned for implementation in the DPR.	Evidence of actions taken from daily panel connects. Evidence of actions planned and implemented through the DSR and DPR.
				9.8	Boilers are prioritised, maintained and confirmed to be functioning in accordance with the CMMS.	Boiler system CMMS maintenance records.
				9.9	Fuel efficiency and steam consumption as a ratio of gas rundown is assessed in the monthly Fuel and Flare Forum to identify if steam demand has changed and to take actions (via the DPR) to minimise fuel demand and reduce emissions.	Fuel and Flare Forum meeting minutes. Evidence of actions implemented through the DPR.
				9.10	Start-up Integrated Work Execution Flow Scheme (WEFS) are implemented during start-ups to optimise fuel gas use.	Records demonstrate WEFS developed and implemented, including GHG minimisation and risk management measures.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			as safely and reliably as possible. Further detailed monitoring of performance and proposed actions are identified in the Daily Surveillance Review (DSR) meeting with implementation of any actions planned in the Daily Production Review (DPR) meeting. To further optimise efficiency and minimise GHG emissions, fuel efficiency and steam consumption as a ratio of gas rundown is assessed in the monthly Fuel and Flare forum, to identify if steam demand has changed and to take actions (via the DPR) to minimise fuel demand and reduce emissions. Work Execution Flow Scheme (WEFS) are also used during start-up activities to assist in optimising activities through things like sequencing and process optimisation in order to reduce emissions associated with the start-up.			
Engineering, Administrative and Procedural	The flare tip ignition system is designed and operated to minimise the impact of flame-out events through automatic ignition upon detection of a flare flame-out event and includes: • Thermocouples for monitoring with redundancy monitoring via thermal camera and CCTV • Auto-ignition capability with redundancy ignitions via the FFG • The Operations Playbook details the action to be taken upon detection of a flare flame-out • Maintenance of the system in accordance with CMMS as defined in Section 10.5.8 and 10.5.9 .	Yes	The flare system is a safety and loss prevention system and is required for the safe disposal of hydrocarbons in the event of process upsets or emergency situations. Flaring of hydrocarbon reduces the GHG emissions in comparison to these gases being vented. Flare tip integrity and ignition system functionality minimises potential for venting, incomplete combustion waste products and smoke emissions. There are four flare tips on Prelude; high pressure and low pressure dry and high pressure and low pressure wet flares. Both low pressure flares are fitted with three pilots, whilst the high pressure flares are fitted with four pilots. Each pilot has two thermocouples, one online and one in spare. The thermocouples are the primary means of monitoring the pilots, with redundancy available through the use of the thermal camera which also has a DCS alarm which activates when a flare flame-out is detected. Each pilot is designed with two ignition mechanisms. The primary means of flare pilot ignition is via the cylinder head temperature gauge pilot ignition skids which rely on the thermocouple feedback to auto-ignite the pilots upon detection of loss of flame. When the pilot is above 150°C, the pilot flame is shown as "PILOT ON" on the local panel and control room operator console. When the pilot is below 150°C, the low temperature alarm ("PILOT OFF" < 150°C) is displayed and the automatic ignition sequence commences. During the automatic ignition sequence, if the system is not already in alarm, each pilot fires in turn at seven second intervals and stops after sixty seconds. If a pilot remains in alarm after one minute, 'Re-ignition Failure' alarms to alert the operator to repeat the ignition sequence via manually intervening on the control room operator console to re-initiate the ignition sequence. The secondary means of igniting the	9.11	Flare flame-outs are detected: • through thermocouple feedback to the DCS through an alarm ("PILOT OFF" <150°C) upon detection of a loss of pilot flame; or • by the thermal camera with a DCS alarm which is activated when a flare flame-out is detected	DCS records of detection of flame-outs events.
				9.12	Flare flame-outs are ignited: • within 5 minutes of detection, through activation of the automatic ignition sequence, which if remains in alarm after one minute triggers manual intervention by the operator to repeat the ignition sequence; or • within 30 mins by following the Operations Playbook for the applicable ignition sequence using the FFG	DCS/PI records demonstrate the duration of flame-out events. Flame- out events recorded in Sphera.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			flare pilot is via the flame front generator which is operated locally in the field. The flame front generator panel is used to create a combustible gas / air mixture within the flame front line (one per pilot nozzle). Only one pilot can be lit at a time by the flame front generator. EPS's 9.11 and 9.12 will be the relevant EPSs for flare monitoring and ignition following the replacement and reinstatement of the primary monitoring and ignitions system as required by EPS 9.14. Until the replacement, EPSs 9.15 and 9.16 will be applied. Maintaining the system in accordance with CMMS will help ensure the functionality of the ECEs is met. ECEs are maintained in accordance with CMMS, as outlined in Section 10.5.8 and 10.5.9 to ensure they are within reliability, availability, and accuracy requirements for the equipment. Performance of the flare system will be tracked through the GHGEMP, annual abatement workshop report, and goal setting process described in Section 10.6.10.6.8. Any flame-out events will be recorded in the DCS and reported in Sphera.	9.13	The following components of the flare tip monitoring and ignition system are categorised as ECEs: • Pilot monitoring system • Flare pilot ignition system • FFG • Thermal Cameras and are prioritised, managed and confirmed to be functioning in accordance with the CMMS.	CMMS maintenance records.
			Replacement and Reinstatement of the Primary Monitoring and Ignitions Systems Between 2021 and 2024, a total of 36 flame-out events, resulting in approximately ~1,400 tCO_2-e of GHG emissions from venting occurred. Each flame-out event was a non-compliance with EPS 8.01 and 9.06 of the previous EP revision. As a result of the repeat ENC's a detailed causal investigation was conducted to identify the potential causes that were preventing the pilot system from operating as designed. It was confirmed that both the primary monitoring and ignition systems were not operating as per design and replacement of the systems was required. The proposed long-term plan for reinstatement of the Prelude flare monitoring and ignition systems is based on the expectation that the flare will be taken out of service during the 2030 maintenance turnaround. Flare outages are planned based on risk-based inspection requirements which currently require the flare to be taken out of service approximately every eight years to monitor corrosion and other degradation mechanisms. The last flare outage was undertaken during the 2023 maintenance turnaround, with the findings analysed under API 570 requirements as committed in Prelude's Safety Case. The results have placed the next risk-based inspection interval at 2030. Additionally, the execution of the works in 2030 provides the opportunity to reduce the Turnaround emissions load by allowing for time to install an ignited vent on the maintenance vent (refer to EPS 10.2). During a turnaround when the flare is out of service, boil-off gas is currently directed to the maintenance vent. The greenhouse gas impact associated with venting of boil-off gas during a maintenance Turnaround with the flare out of service is two orders of magnitude greater than the venting that occurs from the occasional flare flame-out events (i.e. undertaking an additional flare outage in 2026 compared to the planned outage in 2030 would increase Prelude's	9.14	Replacement and reinstatement of the primary monitoring and ignition system will occur during the next planned flare outage, which is currently planned for 2030.	Confirmation of reinstatement of the monitoring and ignition systems through scope closure documentation and sign off.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			emissions two orders of magnitude). Execution of the work in 2026 is therefore not considered ALARP from an emissions perspective. The cost of a flare inspection is significant due to complexity of applying an isolation on the system to allow personnel to safely work on the flare structure. Time for the flare isolation alone was 20 days in duration for the 2023 Turnaround. Flare de-isolation also adds additional time at the back end of the turnaround and within the shutdown and start-up sequencing. A conservative estimate of the additional duration of a Turnaround event by inclusion of a flare outage is 30 days. Based on current LNG pricing the cost of a flare outage in a turnaround is approximately AUD$300 million with the addition of actual scope performed added on top of this (i.e. undertaking an additional flare outage in 2026 compared to the planned outage in 2030 would result in a loss to the Prelude joint venture of approximately AUD$300 million). The RBI program is critical to optimise inspection intervals and allow priority to scope to be executed at the right time. To bring the flare system down in both 2026 and 2030 is grossly disproportionate to the value gained, particularly when reliability of the current system cannot meet the service length expectation of even four years, and is therefore not considered to be ALARP.			
			Thermal Camera Thermal camera monitoring is in place to provide a secondary means of flare monitoring which provides a clear a visual of the flare deck. It has real time analytical capabilities to assess the video feed and determine if a flare flame out has occurred. This is embedded in the DCS system to initiate an alarm when upon instance of a potential flame out. Visual monitoring of the flare with the thermal camera image is also visible to the operator via the CCTV screens at the Upstream Panel and also at the Utilities Panel.	9.15	Until replacement and reinstatement of the primary pilot monitoring system, the thermal camera will be used for monitoring the flare including smart monitoring of the image with a DCS alarm when a flare flame-out is detected. Visual monitoring of the flare via the optical CCTV camera is also available to visually detect flare flame-out events.	DCS records demonstrate detection of flare-flame-out.
			Flame Front Generator (FFG) The FFG will be used for re-ignition while the primary ignition system is in-operable. A testing campaign was conducted in the June/July period of 2024 to confirm the operational availability of the FFG for each of the pilots for each of the flares (14 pilots total). An entry in the Operations Playbook has been made to inform offshore operations to use the FFG in a specific sequence to give the best reliability of re-ignition. Due to the simplicity of the FFG design and its inherent reliability testing of the equipment is not frequently required and an annual testing regime is deemed adequate. Should successive testing campaigns show a significant change or drop in performance of the FFG system testing campaigns will become more frequent if necessary.	9.16	If a flame-out is detected and confirmed via the DCS alarm (or visually), the Operations Playbook is followed for the applicable ignition sequence using the FFG, with the flare reignited within 30 mins of identification of the flame-out.	DCS/PI records demonstrate the duration of flame-out events. Flame-out events recorded in Sphera.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria

Engineering, Administrative and Procedural	Use of N_2 vs Fuel Gas as flare purge.	Yes	By design Prelude needs to have a constant supply of gas to keep flares lit and a constant purge going through the flare headers to avoid air ingress and maintain safe operations. To reduce the GHG impact, the flares should be purged with N_2 as a primary source or with fuel gas as the backup source.
			If all flare headers are on fuel gas purge, ~1,000 tCO_2e is emitted per month. This equates to approximately 0.5% of the total monthly GHG emissions from the facility during steady state operations.
			The LP Wet flare, which currently has no working thermocouples, is purged with fuel gas to minimise the risk of a flame-out event, which results in the emission of ~240 tCO_2-e. Once the thermocouples are reinstated (refer to EPS 9.12) the purge will be switched back to N_2.
			The current base case is for all flare headers (except the LP Wet) is to remain on N_2 purge, except under the following conditions:
			• Unavailability of N_2
			• During functional testing of the FFG as required in accordance with the CMMS
			• If there is a risk that the pilot may not remain alight such as:
			  ○ during extreme weather events
			  ○ during tank inerting
			It is noted however that the pilot and purge gas from the flare is excluded from the planned flaring “holding baseline” as described in EPS 10.9.
				9.17	All flares except LP Wet, remain on N_2 purge except under the following conditions:
					• Unavailability of N_2
					• During functional testing of the FFG as required in accordance with the CMMS
					• If there is a risk that the flare may not remain alight such as:
					  ○ during extreme weather events
					  ○ during tank inerting
						DCS/PI records demonstrate source of purge gas.

Administrative and Procedural	Report emissions where required by the NPI.	Yes	National Pollutant Inventory (NPI) Measure 1998 (established under the *National Environment Protection Council Act 1994* Cth), a system control measure, provides the framework for the development and establishment of the NPI, which provides publicly available information on the types and amounts of substances being emitted into the Australian environment. These substances have been identified as important due to their possible effect on human health and the environment.	9.18	Report types and amounts of relevant NPI substances as required by the National Pollutant Inventory (NPI) Measure 1998.	Public NPI reporting records.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Administrative and Procedural Controls	GHGEMS includes LDAR surveys as detailed in Section 10.7.	Yes	Fugitive emissions make up <1% of the air emissions /from the facility. Leak Detection and Repair (LDAR) surveys form part of the GHGEMS as detailed in Section 10.7. During operations, LDAR surveys will be conducted on an annual basis to identify fugitive emissions from valves, emission points, flanges, or equipment from any hydrocarbon processing and refrigerant use areas of the facility topsides. All identified fugitive emissions are recorded in the facility leak register and risk assessed for maintenance scheduling. Prioritisation of leak repairs is assessed based on a combination of factors including process safety and health risks, impairment complexity and leak magnitude, which incorporates consideration of the resulting GHG emissions. Feasibility of repair is also an important factor when assessing prioritisation of repair. For example, some leaks may require a partial or full facility shutdown to allow for repair, whilst others may be conducted on the run while the facility is operating. Consideration of opportunistic repairs is always retained in the schedule to maximise efficiency.	9.19	Shell will annually conduct, in alignment with OGMP 2.0 requirements: • A site level LDAR survey (Level 4) encompassing all topside modules with hydrocarbon/refrigerant use and; • A source level methane quantification survey (Level 5). An annual reconciliation of OGMP Level 4 and Level 5 data will be completed, with equipment identified as leaking recorded in a leaks inventory (or equivalent), and repair carried out in accordance with the CMMS.	Records of methane emissions including: • Records of OGMP Level 4 and Level 5 completed annually and inclusive of reconciliation efforts. • Records of leak sources identified via OGMP Level 4 (LDAR with leaks quantified) added to a suitable asset leak register or equivalent. CMMS records
Administrative and Procedural Controls	Vessel engines to use low-sulphur content fuel or an IMO approved alternative measure (e.g. EGCS fitted) to reduce sulphur oxide emissions in accordance with Marine Order 97.	Yes	This MARPOL Annex VI requirement, enforced by AMSA Marine Order 97, came into force from 1 January 2020 and applies to all marine vessels operating in the field including offtake tankers. This requirement will also be adopted for FLNG, when required to operate on diesel.	9.20	Use only low-sulphur fuel (≤0.5 m/m S) or an IMO approved alternative measure (e.g. EGCS fitted) to reduce sulphur oxide emissions.	Sulphur content of fuel oil/ diesel, % w/w as verified in bunker receipts. A copy of a maintained Exhaust Gas Cleaning System (EGCS) record book (if relevant).
Administrative and Procedural Controls	Marine support vessels (as appropriate to class) supporting Prelude operations will comply with MARPOL Annex VI (Prevention of Air Pollution from Ships), the *Navigation Act 2012* (Cth), the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and subsequent Marine Orders.	Yes	Marine Order 97, a system control measure, requires specified marine vessels to possess the applicable pollution prevention and energy efficiency certificates. These certificates include Engine International Air Pollution Prevention Certificate (EIAPP), IAPP and an International Energy Efficiency (IEE) Certificate. In addition, all vessels >400 t (gross) are required to carry a Ship Energy Efficiency Management Plan (SEEMP). These requirements are also recognised and enforced in the Shell Marine Assurance Process and procedures.	9.21	Vessels are required to have this valid documentation as required by vessel class, size and type: • EIAPP certificate; • IAPP certificate; • IEE certificate; and • SEEMP.	Marine Assurance Record confirming valid SEEMP and IAPP, EIAPP, IEE certificates are in place for vessels (where required by vessel class, size and type).
				9.22	Waste from incineration managed in accordance with MARPOL Annex VI.	A copy of the completed garbage record book or official recording system that captures incinerated waste records. Records of an IMO type approval certificate for each incinerator in use, demonstrating the incinerator is designed for operation within the limits of Regulation 16 of MARPOL Annex VI.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
				9.23	ODS managed in accordance with MARPOL Annex VI to reduce the risk of an accidental release of ODS to air, as required by vessel class, size and type.	A copy of the current and maintained ODS Record Book or recording system.

ALARP Demonstration Statement

Based on the outcomes of the impact assessment and the control measures adopted, Shell considers that the implemented controls are appropriate to manage the potential impacts associated with atmospheric emissions from the activity. These emissions are consistent with MARPOL and other applicable regulatory requirements, and the facility design incorporates measures to minimise emissions, including flare system improvements and fuel efficiency strategies. No additional or alternative controls were identified that would further reduce the impacts without disproportionate effort or cost. Therefore, the impacts are considered to be reduced to ALARP and acceptable levels.

9.11.5 Acceptability of Impacts

Table 9-87: Acceptability of Impacts – Atmospheric Emissions

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Sub-category**			
Physical Values *and Sensitivities*	Air Quality	No significant impacts to air quality defined as no substantial change in air quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	Yes	Impacts to air quality from atmospheric emissions during the activity will be localised. Given the remoteness of the Activity Area, there is no potential for significant impacts to occur.

The assessment of impacts from atmospheric emissions determined the residual impact consequence to be Slight (Table 9-85). Given that air quality in the area is generally expected to be very high and that there is a lack of sensitive human receptor populations, the residual impact consequence is considered acceptable (Table 9-85). The acceptability of impacts on air quality have been considered in the following context.

Principles of ESD

The potential impacts from atmospheric emissions are considered acceptable and consistent with the principles of ESD because:

- The physical values/sensitivities within the Activity Area are not expected to be significantly impacted
- The precautionary principle has been applied to the impact assessment.

Relevant Requirements

Managing the potential impacts from atmospheric emissions is consistent with relevant legislative requirements, including:

- Air quality in the Prelude regional airshed complies with the NEPM Ambient Air Quality Standards (National Environment Protection Council 1998) and variation to the ambient air quality measure (National Environment Protection Council 2021)
- National Environment Protection (NPI) Measure (NPI NEPM).
- Marine fuel oil used by HP Steam Boilers and marine vessels supporting operations comply with MARPOL Annex VI (Prevention of Air Pollution from Ships), the *Navigation Act 2012* (Cth), the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and subsequent Marine Orders, which require vessels ≥400 t to have a valid IAPP certificate and use low-sulphur fuel.

Matters of National Environmental Significance

Commonwealth Marine Area

The potential impacts and risks from atmospheric emissions from the Activities on the Commonwealth marine environment are predicted to not exceed any of the significant impact criteria, as listed in Table 9-88. Hence it is considered that the aspect does not pose a credible risk to the Commonwealth marine environment.

Table 9-88: Summary of Alignment of the Impacts from the Atmospheric Pollutant Emissions Aspect of the Prelude petroleum activities with Relevant Requirements for EPBC Threatened Fauna

MNES	MNES Acceptability Considerations	Demonstration of Alignment
Commonwealth Marine Area	No significant impacts on air quality	Criteria for significant impacts and risks to air quality over the Commonwealth Marine area where the activity will operate are not considered likely to be exceeded by atmospheric emissions from the activity.

External Context

No objections or claims have been raised by relevant persons to date regarding atmospheric emissions. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4

Internal Context

Shell also considered the internal context, including Shell's environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented for the activity are consistent with the outcomes from consultation for the petroleum activity and Shell's internal requirements.

Acceptability Summary

The assessment of the potential impacts from atmospheric emissions determined the residual impact rankings to be Slight (Table 9-85). As outlined above, the acceptability of the potential impacts and risks from this aspect have been considered in the context of:

- the established acceptability criteria
- ESD
- relevant legislative requirements
- MNES
- external context (i.e. relevant persons claims or objections)
- internal context (i.e. Shell requirements).

The potential residual impacts are deemed to be Slight which Shell considers to be inherently acceptable if they meet legislative and Shell requirements. The discussion above demonstrates that these requirements have been met in relation to the atmospheric emissions aspect.

Shell considers the potential impacts from atmospheric emissions associated with the activity to be ALARP and acceptable.

9.11.6 Environmental Performance Outcome

EPO #	EPO	Measurement Criteria
9.1	Atmospheric emissions associated with the Activity will meet all regulatory source emission standards.	Demonstrated implementation of EPSs for activity atmospheric emissions.

9.12 Greenhouse Gas Emissions

9.12.1 Aspect Context

Greenhouse Gas (GHG) emissions trap heat in the atmosphere, contributing to global temperature increases and are defined in the NGER Act to include CO_2, CH_4 and nitrous oxide (N_2O). Under the NGER Act, other greenhouse gases include perfluorocarbons, hydrofluorocarbons, and sulphur hexafluoride. GHG emissions are measured in Carbon dioxide equivalents (CO_2-e) to standardise their impact.

The GHG Protocol[49] classes GHG emissions as:

- Scope 1: direct GHG emissions produced from sources that are owned or controlled by the company.
- Scope 2: indirect GHG emissions when importing steam, heating, cooling, or electricity for use.
- Scope 3: indirect GHG emissions, are a consequence of the activities of the company, but occur from sources not owned or controlled by the company.

In accordance with guidance from the Clean Energy Regulator on reporting under the NGER Act, in this assessment Scope 1 emissions are 'direct' emissions from activities under the Prelude joint venture partners' operational control and Scope 2 and 3 emissions are 'indirect' emissions outside of the Prelude joint venture partners' operational control[50].

9.12.2 Methodology and Assumptions

CO_2-e are calculated using global warming potentials and emission factors from the National Greenhouse and Energy Reporting (Measurement) Determination 2008 or National Greenhouse Account Factors, GHG Protocol Corporate Value Chain Scope 3 Accounting and Reporting Standard (WRI/WBCSD 2011) and ISO 14040:2006 Life Cycle Assessment Principles and Framework (ISO 2006) based on the current Operating Plan production estimate.

This assessment adopts a conservative approach and considers:

- GHG emissions from the processing of production from Prelude wells at the Prelude FLNG facility (Prelude Energy)
- GHG emissions from the processing of production from the Crux wells at the Prelude FLNG facility (during the period of the Crux activity) (Crux Energy[51])
- The combined emissions of Prelude Energy and Crux Energy at the Prelude FLNG facility.

The calculation methodologies used to estimate Scope 3 GHG emissions associated with the Activity (see include:

- **'End Use'** Scope 3 GHG emissions are the emissions related to the combustion of all products processed at the Prelude FLNG facility by energy consumers, such as power plants
- **'Life Cycle'** Scope 3 GHG emissions are the emissions related to the value chain, where emissions occurring during fabrication and transport, processing and third-party end use are included.

Consistent with how the facilities are set up for reporting under the NGER Act, in this assessment GHG emissions are generated from:

- the activities under the Prelude joint venture partners operational control are treated as Scope 1 and 'direct' emissions (this includes the processing of Crux gas on Prelude)
- emissions produced from activities outside the operational control of the Prelude joint venture partners are treated as Scope 3 and 'indirect' emissions.

[49] ghg-protocol-revised.pdf (ghgprotocol.org)

[50] Emissions and energy types | Clean Energy Regulator (cer.gov.au)

[51] The use of terms Crux Energy and Prelude Energy is to enable differentiation at the Prelude FLNG facility.

- Scope 2 GHG emissions are not expected from the Activity.

Scope 3 and total GHG emissions are shown as an incremental increase to global GHG inventory and carbon budgets for this assessment, because third party end user GHG emissions will not count toward Australian inventories and carbon budgets and will instead be accounted for in the end-use countries under their respective domestic and international GHG emissions control frameworks.

9.12.2.1 Detailed Assumptions

GHG forecasts in this EP are based on P50 probability Operating Plan estimates which means there is a 50% chance that the actual production outcome will be greater than or equal to this value, and a 50% chance it will be less than or equal to it.

The P50 forecasts are further subdivided into stream and non-stream days. Commercial sensitivity applies to many aspects of the underpinning assumptions, however, they can be broadly defined as follows:

- Stream days refer to emissions while Prelude is stable and fully operational.
    - The stream GHG emissions are primarily calculated along with the production forecast using output tables programmed in the reservoir Integrated Production System Model (IPSM). The IPSM output tables estimates how much fuel gas is required to process a certain volume of hydrocarbon through the facility. This can be used to estimate emissions from fuel combustion for power and steam generation, reservoir venting via Acid Gas Removal Unit and an estimate of leaks (fugitive emissions).
    - For the 5-year term of this EP, the annual stream day P50 assumptions range from ~72% to ~92% for the years 2026 to 2030 (utilisation). The remainder are classified as ‘non-stream’ days.
- Non-stream days refer to the times when Prelude is not producing at maximum throughput. Non-stream days have been calculated using the same reliability probability model that is used to determine utilisation. Factors such as (but not limited to) weather events, turnarounds, Crux start-up, subsea and well integrity testing, and equipment failures contribute to the reliability factors that influence the non-stream day probabilities. In addition to the utilisation factors, the non-stream day calculation estimate considers operational modes, performance history and associated downtime/response times, and includes (but is not limited to) the following assumptions:
    - Utilisation has been calculated in detail for 2026-2030 (5-year EP term). For the lifecycle forecast (beyond 2030), the non-stream emissions are assumed to not change.
    - During turnarounds, a minimum of one boiler will remain running on diesel to preserve life support systems.
    - Well flow during outages is taken as the sum of fuel gas (e.g., from wells and LNG vaporiser (if required)), vent and flaring (blowdown (only for emergency depressurisation) and flaring during restart).
    - Flaring from wells is the sum of all restart flaring, troubleshooting and depressurisation volumes when an emergency depressurisation was mentioned in the scenario.
    - Historical performance data is used to estimate the AGRU vent flow and transient fuel gas consumption during the different trip scenarios, for simplicity this was averaged and referenced as transient.
    - Vented carbon dioxide from the acid gas vent has been accounted for in all scenarios where well gas is used for either restart flaring or fuel purposes.
    - There may be operational flaring when some compressors (end flash and overhead) are offline, and the average of operating data was used to forecast the expected flaring in such events.
    - Where production outages lead to shutdown, the time to restart the facility has been included in the duration of that shutdown. During restart activities there will be a period of flaring while gas is brought to desired specification before feeding forward to the next part of the plant.

  - Assumptions do not factor depressurisation duration as this typically is negligible when compared to a plant restart. The additional flaring of full plant inventory has been factored into the relevant scenarios. The three types of plant trips assumed include cold end trip (where condensate is still produced but no LNG production), general process shutdown and emergency depressurisation (where wells shut but boilers could be running on diesel/vaporised LNG).

- The emissions forecasts exclude the marine and maintenance vents:
  - The marine vent is the final pressure protection for the condensate and cryogenic tanks, as well as other small tanks, and is continuously purged with nitrogen. To date there have been no reported GHG emissions from the marine vent and there are no emissions forecast to occur.
  - The maintenance vent is primarily used as flare relief when the flare undergoes maintenance (approximately every 8-12 years). To date GHG emissions have only been recorded from the maintenance vent during the 2023 turnaround when the flare was taken out of service to undergo maintenance (refer to Table 9-89). The next scheduled flare outage is currently planned for the 2030 turnaround during which time an igniter system will be installed to reduce GHG emissions (refer to EPS 10.3). If a similar amount of hydrocarbons were to be emitted from the maintenance vent during the 2030 turnaround as were emitted in 2023 (which is considered worst-case), but were ignited rather than vented, this would result in ~0.0088 $MtCO_2$-e, which constitutes ~0.07% of the forecast 5 year total direct emissions (Table 9-91). Given the uncertainties in the amount of hydrocarbons that may be ignited through the maintenance vent during the 2030 turnaround and the negligible amount this would contribute to overall emissions, this volume has not been included in the GHG emission forecast for the period.
- Emission factors for Scope 3 emissions are calculated using Shell Product Value Chain Intensity Metrics (in alignment with GHG Protocol Corporate Value Chain Scope 3 Accounting and Reporting Standard (WRI/WBCSD 2011); associated Technical Guidance for Calculating Scope 3 Emissions (WRI/WBCSD 2013) and ISO 14040:2006 Life Cycle Assessment Principles and Framework (ISO 2006)).
  - These included the following factors in $kgCO_2$-e/kg product: LNG Shipping (0.068); LNG Regasification (0.02); LNG/Gas Pipeline (0.024); LNG Power Station (2.83); LPG Refinery (0.22); LPG Distribution (0.03); LPG End Use (3.05); Condensate Refinery (0.22); Condensate Distribution (0.03); Condensate End Use (3.05).
- Factors utilised to calculate emissions and convert tonnes hydrocarbon to CO_2, CH_4, N_2O, and CO_2-e include:
  - Emissions from flaring: Subdivision 3.3.9A.10 - natural gas production (emissions that are flared); Section 3.86 Method 1; NGER Determination 2008. The applicable emission factors for CO_2, CH_4 and N_2O are as 2.7, 0.133 and 0.026 tonnes CO_2-e per tonne fuel flared respectively.
  - Fugitive emissions: Division 3.3.6E - natural gas processing (other than emissions that are vented or flared); Section 3.7.Q Method 1; NGER Determination 2008.
  - Emissions from combustion of diesel: Division 2.4.2 - emissions from liquid fuels; Section 2.41 Method 1; NGER Determination 2008. The applicable emission factors are taken from Schedule 1, Part 3, Item 40 (NGER Measurement Determination). For CO_2, CH_4 and N_2O are 69.9, 0.1- and 0.2 $kgCO_2$-e per GJ respectively, and energy content factor 38.6 GJ/kL.
  - Emissions from combustion of fuel gas: 50.90 GJ/ton is used for energy content factor of fuel gas based on reporting under the NGER Act, as is the emission factor for CO_2 which is derived from Division 2.3.3; Method 2. The emissions factor for CH_4 and N_2O are 0.1- and 0.03 $kgCO_2$-e per GJ respectively, taken from Schedule 1, Part 2, Item 21 (NGER Measurement Determination).
- The following general assumptions apply to all GHG forecasts:
  - Variance within the EP and lifecycle periods may occur.
  - The data is based on current mid-case Operating Plan, which may change.
  - The Operating Plan has inbuilt assumptions on utilisation rates and outcome probabilities.

- The Operating Plan is based on mid-case production outcomes and probabilities, which may change based on actual level of reservoir and/or systems performance.
- While assumptions made have been robustly considered, actual GHG emissions may vary based on operational factors and changes to Operating Plan.
- Operating Plan and forecasts are reviewed regularly and may change which will change forecasts.
- Data extracted from detailed emissions model - due to rounding of this data - some totals may not appear to be exact.

9.12.3 GHG Emissions Summary

GHG emissions for the period between 2017 and 2025 are set out in Table 9-89.

Forecasts for the five-year EP period (2026–2030) and lifecycle duration are provided as follows:

- Direct emissions (Scope 1): Prelude Energy (Table 9-90 and Figure 9-12).
- Direct emissions (Scope 1): Prelude and Crux Energy (Table 9-91 and Figure 9-13).
- Indirect emissions (Scope 3): Infield marine vessels and aviation – Prelude and Crux (Table 9-92)
- Indirect emissions (Scope 3): Supply chain, transport, and third-party end use – Prelude (Table 9-93).
- Indirect emissions (Scope 3): Supply chain, transport, and third-party end use – Prelude and Crux (Table 9-94).
- Total direct (Scope 1) and indirect (Scope 3) GHG emissions: Prelude and Crux (Table 9-95).

The data provided differentiates between Prelude and Crux energy. The contribution of Crux energy varies over time, gradually replacing the depleting Prelude energy.

The total forecast direct (Scope 1) GHG emissions from Prelude and Crux energy are estimated to be 12.471 $MtCO_2$-e over the EP period and 35.916 $MtCO_2$-e over the project lifecycle, with a lifecycle annual average of 2.245 $MtCO_2$-e (Table 9-91 and Figure 9-13).

The total forecast direct (Scope 1) and indirect (Scope 3) GHG emissions from Prelude and Crux energy are estimated to be 75.98 $MtCO_2$-e over the EP period and 205.79$MtCO_2$-e over the project lifecycle, with a lifecycle annual average of 12.24 MtCO2-e (Table 9-95).

Under the NGER Act the Prelude FLNG is a Safeguard facility as it exceeds the 100kt CO2-e threshold each year. There is only one SGM baseline for the Prelude FLNG facility (i.e., which will apply to the processing of Prelude and Crux gas through the FLNG).

Under the SGM legislation, the SGM baseline is a production-adjusted floating baseline. Crux, as a new gas field, has an emission intensity of zero for reservoir CO_2 (i.e. will be required to offset 100% of its reservoir CO_2). The Prelude gas field is considered an existing gas field and its reservoir CO_2 contributes towards the SGM baseline. The Operator will allocate Prelude FLNG's SGM liabilities between the Crux joint venture partners and the Prelude joint venture partners. The Prelude FLNG SGM baseline is allocated to the Crux & Prelude fields based on their volume of gas and reservoir CO_2 from each field.

As per latest emissions forecasts, presented in Table 9-90 and Table 9-91, the Prelude facility emissions will exceed the SGM baseline once Crux comes online, and the SGM liability will increase as the SGM baseline gradually declines over time. The consequence of exceeding the SGM baseline is therefore entering a position of carbon liability (i.e. required to offset excess emissions by carbon credit surrendering or implementation of further GHG abatement at the facility-level).

The Crux platform will be classified as a separate SGM facility if it exceeds the threshold in any given year, particularly during the start-up phase. Latest emissions forecasts indicate that it is likely that the Crux platform will become a SGM facility and require its own baseline for at least one year during initial commissioning and start-up. It is however important to note that the SGM review scheduled for 2026/27 may result in changes to

the details in the SGM legislation with regards to how SGM baselines are calculated. Decline rates are also going to be reviewed and may be subject to change."

Table 9-89: Prelude FLNG Actual Annual Emissions from 2017 – 2025

Emission Source	GHG Emissions Actual ($MtCO_2$-e)[1]							
	FY17/18	**FY18/19**	**FY19/20**	**FY20/21**	**FY21/22**	**FY22/23**	**FY23/24**	**FY24/25**
Direct Emissions (Scope 1)								
Reservoir CO_2 (AGRU)	-	0.092	0.299	0.295	0.553	0.609	0.538	0.773
Power Generation (Fuel Gas)	-	0.402	0.674	0.668	0.926	1.111	0.881	1.293
Flaring	0.014	1.680	0.778	0.449	0.280	0.375	0.222	0.114
Diesel Combustion	0.240	0.165	0.069	0.089	0.038	0.033	0.070	0.009
Fugitive Emissions	0	0.001	0.003	0.004	0.042	0.060	0.057	0.066
Maintenance Vent	-	-	-	-	-	-	0.085	-
Flame-out Events	-	-	-	0.001	0.001	0.000	0.000	0.000
Actual Total	**0.254**	**2.340**	**1.822**	**1.507**	**1.841**	**2.189**	**1.852**	**2.254**
Indirect Emissions (Scope 3)								
Marine Vessels	0.030	0.036	0.018	0.016	0.014	0.018	0.059	0.025
Aviation	0.006	0.009	0.006	0.005	0.004	0.005	0.007	0.006
Total Prelude GHG Emissions (Direct and Indirect)	**0.289**	**2.385**	**1.846**	**1.527**	**1.859**	**2.212**	**1.918**	**2.285**

Note 1: $MtCO_2$-e = Million tonne of carbon dioxide equivalent

Table 9-90: Forecast Direct GHG Emissions (Scope 1) – Prelude

Emission Source ($MtCO_2$-e)	2026	2027	2028	2029	2030	5 Year Total / (%)	5 Year Average	Lifecycle Total / (%)	Lifecycle average
Reservoir Vented CO_2 (AGRU)	0.586	0.626	0.535	0.447	0.324	2.520 (36.0%)	0.504	3.709 (36.3%)	0.366
Power Generation (Fuel Gas)	1.057	1.103	0.748	0.621	0.458	3.987 (57.0%)	1.035	5.727 (56.1%)	0.571
Flaring	0.083	0.064	0.041	0.032	0.030	0.250 (3.6%)	0.050	0.363 (3.6%)	0.036
Diesel Combustion	0.006	0.004	0.004	0.004	0.006	0.024 (0.3%)	0.005	0.034 (0.3%)	0.003
Fugitives	0.051	0.054	0.049	0.044	0.036	0.233 (3.0%)	0.047	0.414 (4.0%)	0.038
TOTAL Emissions ($MtCO_2$-e)	1.783	1.851	1.377	1.148	0.855	7.014 (100%)	1.403	10.247 (100%)	1.01

Table 9-91: Forecast Direct GHG Emissions (Scope 1) – Prelude and Crux

Emission Source ($MtCO_2$-e)	2026	2027	2028	2029	2030	5 Year Total / (%)	5 Year Average	Lifecycle Total / (%)	Lifecycle average
Reservoir Vented CO_2 (AGRU)	0.586	0.739	1.146	1.258	1.073	4.801 (38.6%)	0.960	13.549 (38.0%)	0.847
Power Generation (Fuel Gas)	1.057	1.242	1.511	1.627	1.404	6.843 (55.0%)	1.367	19.724 (55.3%)	1.233
Flaring	0.083	0.073	0.077	0.077	0.085	0.396 (3.2%)	0.079	1.257 (3.5%)	0.079
Diesel Combustion	0.006	0.004	0.004	0.004	0.006	0.024 (0.2%)	0.0048	0.069 (0.2%)	0.004
Fugitives	0.051	0.072	0.096	0.100	0.089	0.409 (3.3%)	0.082	1.130 (3.2%)	0.071
TOTAL Emissions ($MtCO_2$-e)	1.783	2.130	2.835	3.066	2.657	12.471 (100%)	2.494	35.916 (100%)	2.245

Table 9-92: Forecast Indirect GHG Emissions (Scope 3) – Infield Marine Vessels and Aviation – Prelude and Crux

Emission Source ($MtCO_2$-e)	2026	2027	2028	2029	2030	5 Year Total / (%)	5 Year Average	Lifecycle Total / (%)	Lifecycle Average
Marine Vessels	0.036	0.036	0.036	0.036	0.036	0.18 (80%)	0.036	0.612 (80%)	0.036
Aviation	0.009	0.009	0.009	0.009	0.009	0.045 (20%)	0.009	0.153 (20%)	0.009
TOTAL GHG Emissions	0.045	0.045	0.045	0.045	0.045	0.225 (100%)	0.045	0.765 (100%)	0.045

Table 9-93: Forecast Indirect GHG Emissions (Scope 3) – Supply Chain, Transport, and Third-Party End Use – Prelude

Emission Source ($MtCO_2$-e)	2026	2027	2028	2029	2030	5 Year Total / (%)	5 Year Average	Lifecycle Total / (%)	Lifecycle Average
LNG	6.220	6.587	5.731	4.760	2.809	26.11 (70.9%)	5.22	45.60 (70.7%)	2.68
LPG	0.655	0.699	0.588	0.489	0.288	2.7 (7.4%)	0.54	4.84 (7.5%)	0.28
Condensate	2.121	2.105	1.646	1.334	0.788	8.0 (21.7%)	1.60	14.06 (21.8%)	0.83
TOTAL GHG Net Emissions	9.00	9.39	7.97	6.58	3.89	36.82 (100%)	7.36	64.5 (100%)	3.79

Table 9-94: Forecast Indirect GHG Emissions (Scope 3) – Supply Chain, Transport, and Third-Party End Use – Prelude and Crux

Emission Source ($MtCO_2$-e)[52]	2026	2027	2028	2029	2030	5 Year Total / (%)	5 Year Average	Lifecycle Total / (%)	Lifecycle Average
LNG	6.22	7.44	10.91	11.59	9.31	45.47 (72%)	9.09	123.77 (73.2%)	7.28
LPG	0.65	0.75	0.87	0.87	0.65	3.79 (6%)	0.76	9.55 (5.6%)	0.56
Condensate	2.12	2.38	3.28	3.46	2.77	14.0.1 (22%)	2.80	35.78 (21.2%)	2.10
TOTAL CO_2-e Net Emissions	9.00	10.57	15.06	15.92	12.73	63.28 (100%)	12.66	169.10 (100%)	9.95

Table 9-95: Total Forecast Direct (Scope 1) and Indirect (Scope 3) GHG Emissions – Prelude and Crux

Emission Source ($MtCO_2$-e)	2026	2027	2028	2029	2030	5 Year Total	5 Year Average	Lifecycle Total	Lifecycle Average
Direct Emissions (Scope 1)									
Reservoir Vented CO_2 (AGRU), Combustion, Flaring, Fugitives	1.783	2.130	2.835	3.066	2.657	12.471	2.494	35.916	2.245
Indirect Emissions (Scope 3)									
Infield Marine Vessels & Aviation	0.045	0.045	0.045	0.045	0.045	0.225	0.045	0.765	0.045
Supply Chain, Transport, and Third-Party End Use	9.00	10.57	15.06	15.92	12.73	63.28	12.66	169.10	9.95
Total Scope 3	**9.05**	**10.61**	**15.11**	**15.96**	**12.78**	**63.51**	**12.70**	**169.87**	**9.99**
TOTAL CO_2-e Net Emissions	10.83	12.74	17.95	19.03	15.44	75.98	15.20	205.79	12.24

[52] Calculated using Shell Product Value Chain Intensity Metrics (in alignment with GHG Protocol Corporate Value Chain Scope 3 Accounting and Reporting Standard (WRI/WBCSD 2011); associated Technical Guidance for Calculating Scope 3 Emissions (WRI/WBCSD 2013) and ISO 14040:2006 Life Cycle Assessment Principles and Framework (ISO 2006) based on Crux Financial Investment Decision (FID) Estimate. These included the following factors in kgCO_2-e/kg product: LNG Shipping (0.068); LNG Regasification (0.02); LNG/Gas Pipeline (0.024); LNG Power Station (2.83); LPG Refinery (0.22); LPG Distribution (0.03); LPG End Use (3.05); Condensate Refinery (0.22); Condensate Distribution (0.03); Condensate End Use (3.05).

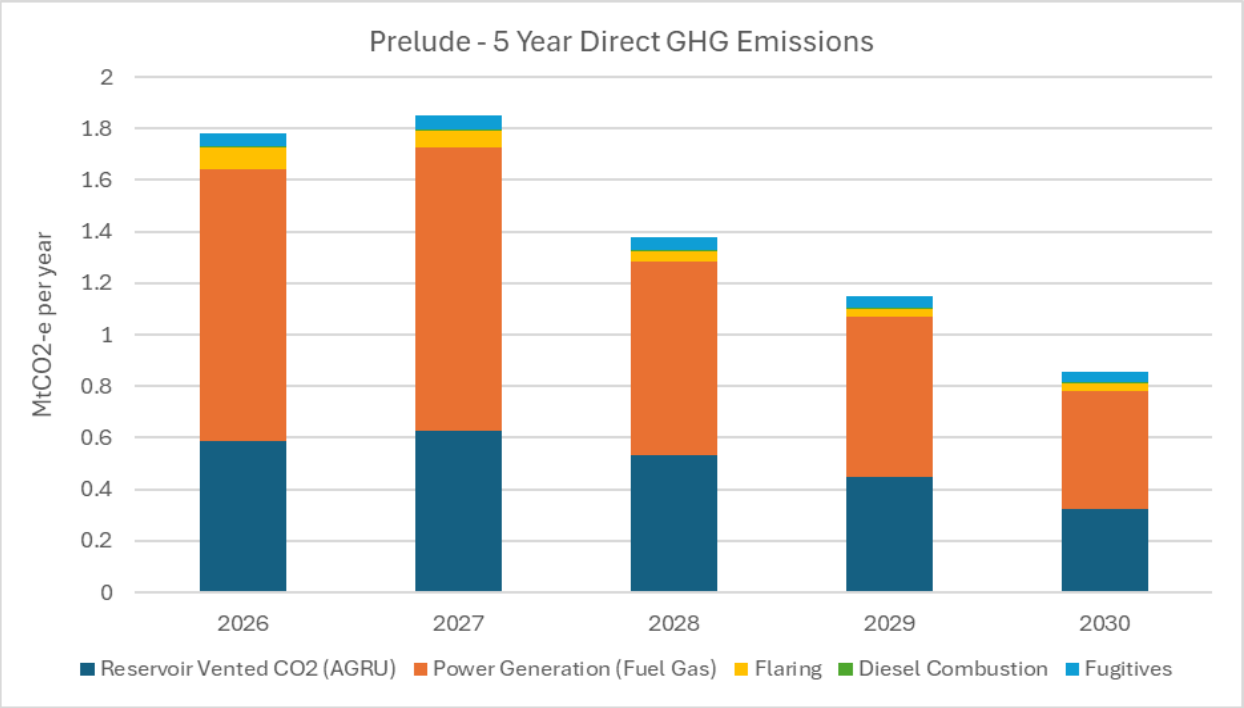


Figure 9-12: Prelude - Direct GHG Emissions (Scope 1)

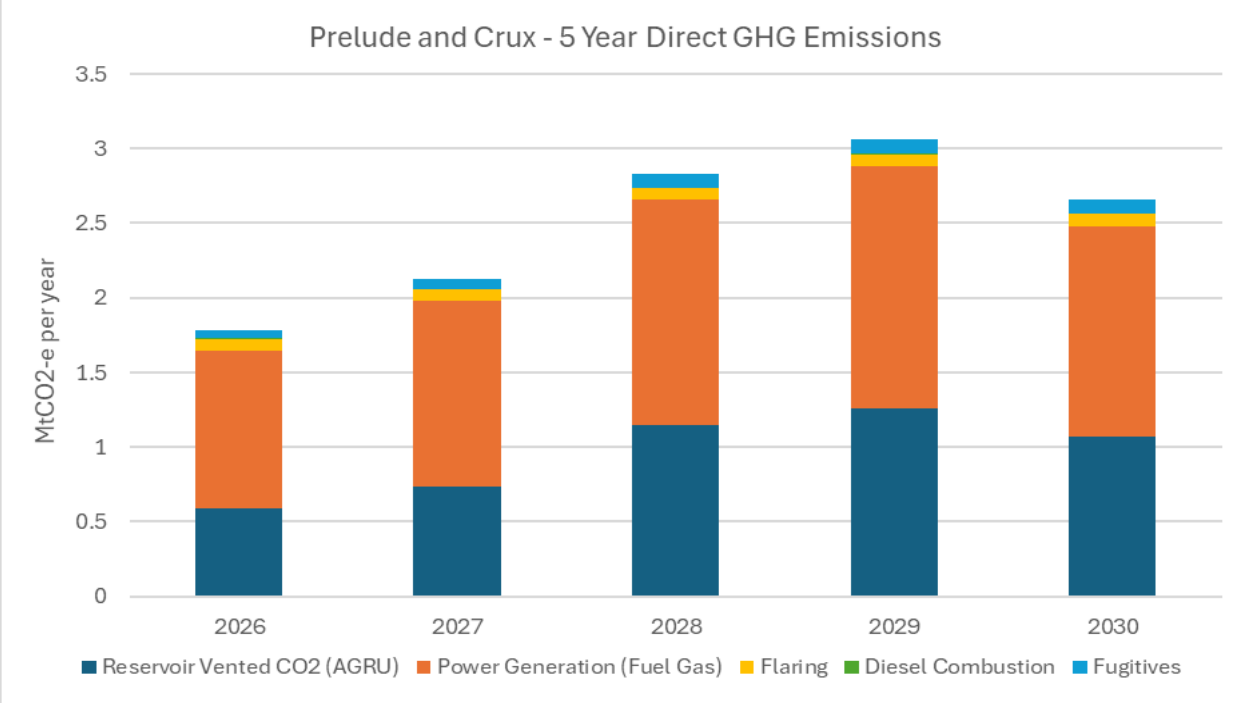


Figure 9-13: Prelude and Crux – Direct GHG Emissions (Scope 1)

9.12.4 Direct GHG Emissions (Scope 1)

The direct (total) GHG emissions from Prelude and Crux energy are estimated to be 12.471 $MtCO_2$-e over the EP period (annual average 2.494 $MtCO_2$-e) and 35.916 $MtCO_2$-e over the project lifecycle (annual average 2.245 $MtCO_2$-e) (Table 9-91). The forecast is also presented as Prelude energy only in Table 9-90 and Figure 9-12).

The proportional allocation of direct (Scope 1) emissions to different sources is summarised as follows for the EP period (with similar proportions over the lifecycle) (Table 9-91 and Figure 9-12):

- ~38.6% of emissions are attributed to the venting of reservoir carbon dioxide through the AGRU (refer Section 9.12.4.1).
- ~55.2% of emissions are attributed to fuel combustion (fuel gas) for the purposes of power generation (refer Section 9.12.4.2).
- ~3.2% of emissions are attributed to flaring for the purposes of pressure relief and safe operations (refer Section 9.12.4.3).
- ~0.2% of emissions are attributed to diesel combustion (refer Section 9.12.4.2)
- ~3.3% are attributed to fugitive emissions from processing facilities (refer Section 9.12.4.4).

9.12.4.1 Venting of reservoir carbon dioxide (AGRU)

The AGRU removes reservoir-derived acid gases (CO_2, traces of H_2S and mercaptans) from the feed gas by contact with a lean amine based solvent stream. The resulting rich amine is then regenerated, and the separated CO_2 rich acid gas stream is routed for safe venting to atmosphere.

9.12.4.2 Combustion for power generation

A steam cogeneration process supplies steam for heating duty and power generation at the required quality, availability and reliability during all operation modes. The total design power requirement is 74.9 MW, including the marine thrusters. To supply this, seven steam generator boilers (in a 6+1 configuration) are installed which generate up to 1300 t/hr of steam. To produce this steam, the boilers may operate on fuel gas or diesel, and the combustion of these fuels results in GHG emissions. For main electrical power generation, the steam is supplied to three steam turbine generators (2+1 configuration). As part of the energy efficient steam cogeneration, the boilers also produce high pressure steam which is routed to the process for heating duty.

Emissions from the combustion of diesel fuel also occurs intermittently via three 7.69 MW Essential Marine Diesel Generators (EMDG) on stand-by during normal operations. The function of these EDGs include providing power to critical instrumentation load during process shutdown. Additionally as a minimum during a turnaround (average of a 2 month period every 4 years), one boiler will remain running on diesel to preserve life support systems. As the reliability of the facility has improved diesel usage has decreased significantly from ~ 7% of total emissions in FY18/19 to <0.4% in FY24/25. Forecast GHG emissions from diesel combustion over the 5 year period of this EP are predicted to be 0.2% of total emissions.

9.12.4.3 Flare system

The purpose of the pressure relief and liquid disposal systems is to collect and safely dispose of hydrocarbon-containing vapour and liquid streams that are released during start-up, shutdown, venting, draining, upsets, maintenance and emergency situations. The combustion of gas in the flare system results in emissions to atmosphere. The pressure relief system comprises:

- Dry Flare System - comprising a HP system which protects primarily process equipment and a LP system which provides relief for storage tanks (also referred to as cold dry high- and low-pressure flare system). This system handles cold and dry streams and cryogenic streams which do not contain water.
- Wet Flare System - comprising a HP system which protects primarily process equipment and a LP system which provides relief for storage tanks (also referred to as warm wet high- and low-pressure flare system). This system handles streams that may contain water and when mixed with cold relief streams, may form ice and hydrates.

The flare systems are designed for:

- Operational flaring: start-up (or restart) operational flare loads determined from events during start-up, tank cool down, or downstream system upset. During start-up, hydrocarbon gas and/or liquid is sent to the flare systems until the LNG train reaches the required specification.
- Flare loads from each individual unit resulting from individual operational failure cases (e.g. control loop/valve failure, reflux/pump failure, blocked outlet, over heating or operator error).
- Simultaneous flare loads from multiple units resulting from common mode failure (e.g. utility failure such as instrument air failure, power failure, cooling water failure or steam failure).

Flaring performance on Prelude has improved significantly since commencement of operations in 2018 (refer to Table 9-89), with peak flaring GHG emissions of 1.68 $MtCO_2$-e in FY18/19, compared to only 0.114 Mt CO_2-e in FY24/25. Forecasts predict a yearly average of 0.079 $MtCO_2$-e (or approximately 3.2% of total emissions over the life of this EP) (refer to Table 9-91).

The improved reliability of the facility together with the implementation of the Automated Process Control (APC) to automatically adjust Main Cryogenic Heat Exchanger (MCHE) parameters to minimise fuel gas supply when required, and LNG tank pressures to ensure oversupply of the FG network is minimised, has contributed significantly to the reduction of flaring volumes.

- Flaring sources from Prelude can be broken down into three broad categories:
- Continuous Operational Flaring
- Planned Intermittent Flaring
- Unplanned Flaring

A description of the various flaring sources both planned and unplanned including their contributions to the overall GHG emissions from flaring activities (based on 2025 operational data as a representative year) is provided below and in Figure 9-13.

Continuous Operational Flaring

Flare Pilot and Purging

By design, Prelude requires a constant supply of gas to keep flares lit and a constant purge going through the flare headers to avoid air ingress and the safety implications of a flammable mixture in one of the 4 flare headers. Pilot flaring is therefore safety critical and cannot be eliminated. The flare pilots can be purged with either N_2 or fuel gas, however as per EPS 9.17, to reduce the GHG impact, the flares should be purged with N_2 as a primary source or with fuel gas as the backup source. Approximately 2-4 t/day of fuel gas or N_2 is sent to each flare header. During 2025 flare pilot and purge gas contributed to ~9% of the total GHG emissions from flaring.

Condensate Tanks

The condensate tank is not designed to route back to fuel gas, therefore any vapour generated will be sent to Prelude's flare system. Vapour from the condensate tanks is flared continuously to the low-pressure wet flare (FWL). Flaring from this source on average contributes ~ 6.3 tHC per day, with a maximum of ~11 tHC per day. In 2025, flaring from the condensate tanks contributed to ~6% of the GHG emissions from flaring.

Produced Water Flash Gas Vessel (V-64031)

During normal operations, absorbed gas from the produced water flash gas vessel is flashed to the low-pressure wet flare (FWL) continuously. Flaring from this source on average contributes ~1.2 tHC per day, with a maximum of ~6.5 tHC per day. In 2025, flaring from the condensate tanks contributed to ~1% of the GHG emissions from flaring.

Loading Operations

During LNG offtakes, which occur approximately every 4-6 days, Prelude's fuel gas network has an excess supply of fuel gas. To help reduce the resultant excess flaring, the facility aims to minimise all fuel sources to create a sink big enough to absorb the BOG/vapour return from the carrier into Prelude's fuel network.

Average flaring performance during offtakes has improved significantly over the last 2-3 years, with near zero offtake flaring possible when all operational levers are available and can be effectively set at optimum on both the facility and carrier sides. Flaring during offtakes in 2025 contributed to only ~1% of the total GHG emission from flaring.

However, several factors that can still contribute to additional flaring during offtakes include:

- Operation of the Wet Fuel Gas Heater which consumes the fuel gas buffer from the sink created to accommodate additional supply from carrier and offtake activity.
- Split parcels to allow tank consolidation in both Prelude and carrier side. These are occasionally required due to operational or weather constraints.
- Cargo cooldown activity.

Planned Intermittent Flaring

Planned Shutdowns and Start-Ups

Planned facility shutdowns and subsequent start-ups, such as turnarounds, which are scheduled for ~4 years, are conducted in accordance with the Prelude Operations Playbook. The Operations Playbook provides direction to the panel operator and ensures that GHG emissions are minimised. A planned shutdown and start-up is estimated to result in ~1-2 $ktCO_2$-e.

Planned Inspections/Maintenance

Planned equipment inspections/maintenance, such as tank inspections, may result in scenarios where additional flaring is required. Such events are scheduled as required as part of the Integrated Activity Planning (IAP) process, with GHG impacts considered in the planning, including a specific focus on consolidation of work scopes to minimise depressurization/gas purging activities. In accordance with the Fuel and Flare Policy any event that is likely to result in a >5 $ktCO_2$-e increase in incremental GHG emissions or is likely to result in flaring for a duration of longer than 5 days requires an ALARP assessment.

During 2025, planned equipment inspections/maintenance activities accounted for ~3% of the total GHG emissions that occurred from flaring.

Well Interventions

There are no planned well intervention or workover activities during the 5 year life of this EP. However, any unplanned well activities would be undertaken in accordance with the Prelude WOMP, including the management of any flaring to ALARP.

Unplanned Flaring

Reliability of the facility significantly impacts the amount of unplanned flaring that occurs on Prelude and therefore the amount flared will vary each year depending on the number and type of unplanned flaring events, and the associated duration of such flaring. During 2025, ~80% of the GHG emissions associated with flaring were from unplanned events, with the majority of these emissions occurring in January and February as a result of two full facility trips.

Unplanned flaring events can occur for numerous reasons when it is required to protect the integrity of the facility and to prevent harm to personnel, the environment and equipment. Such events include, but are not limited to:

- Trips and shutdowns/start-ups, ranging from full facility trips, to warm end or cold end trips, or equipment/compressor trips
- Management of tank tops requiring ramp down of production
- Fuel gas imbalances

- Equipment impairments, including passing valves

The Prelude Operations Playbook includes direction to panel operators that depending on which type of trip the facility has experienced, what fuel mode to run the plant on in order to minimise total GHG emissions. For those events not captured in the Operations Playbook these will be managed in accordance with the Prelude Fuel and Flare Policy, with an ALARP assessments required for any event that is likely to result in a >5 ktCO2e increase in incremental GHG emissions or result in flaring for a duration of longer than 5 days.

Where equipment impairments, including passing valves, are contributing to flaring, every effort is made where feasible to conduct the required maintenance activities whilst the facility is online. The CMMS process considers the GHG impacts due to the impaired equipment and adjusts priorities as required. It is important to note, however, that some impairments may require a facility shutdown to allow the required maintenance to be undertaken.

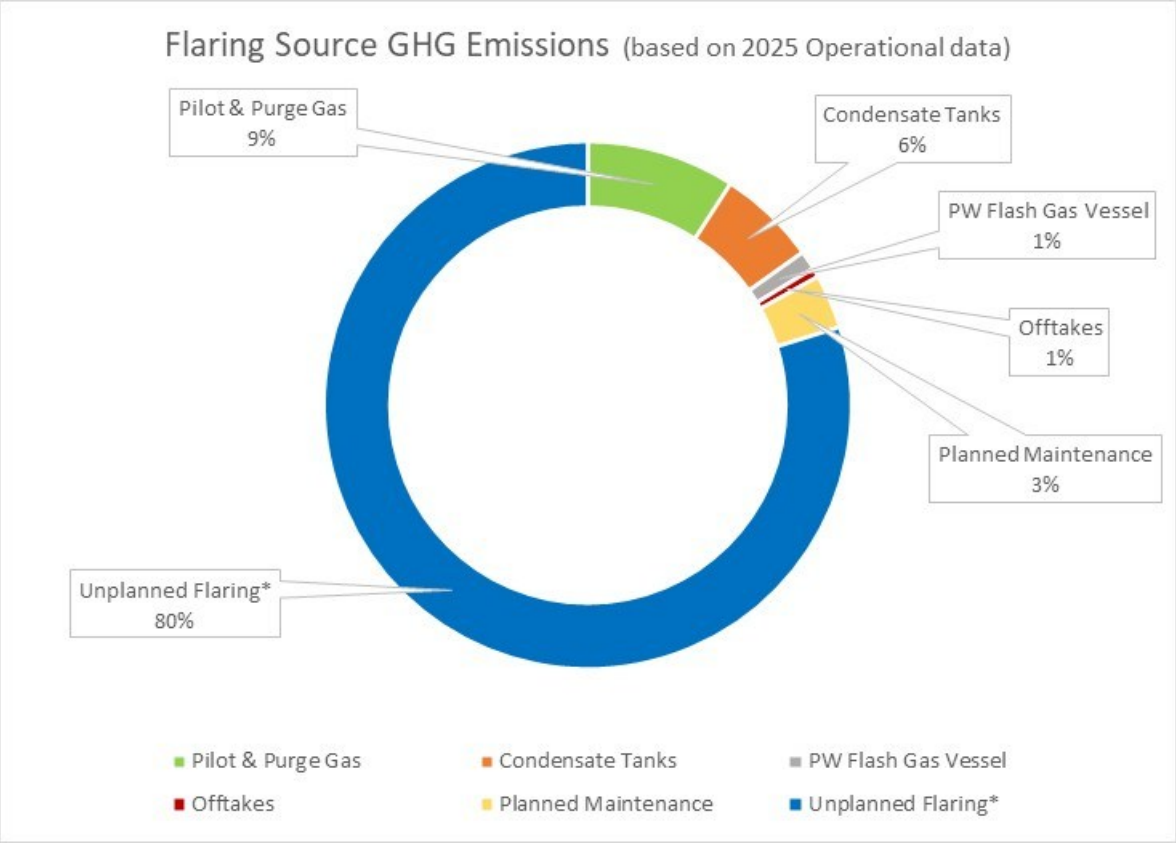


Figure 9-13: Flaring sources both planned and unplanned including their contributions to the overall GHG emissions from flaring activities in 2025.

Prelude, aims to continuously reduce overall GHG emissions through flaring optimisation, which includes:

- Managing reliability of key equipment which directly relates to flaring (e.g. end flash gas compressor).
- Implementing operational improvements to reduce flaring.
- Optimising fuel mode to reduce emissions during Start-up and Shutdowns (through implementation of Prelude FLNG Operations Playbook).
- Implementation of daily flare monitoring workflow, with findings discussed in the Daily Surveillance Review meeting (DSR).
- Daily flaring performance target monitoring including alerts via UTL shift report/target report.

9.12.4.4 Fugitive Emissions

Fugitive emissions to the atmosphere are from sources that include vents on process vessels and tanks, breathers, valves, pump seals, piping components, piping connections, sampling connections, analysers, instruments, HVAC systems, and switchgear and may occur during maintenance or whilst in operation. Fugitive emissions are either inherent in design or occur unexpectedly from equipment leaks. Small volumes of non-ozone depleting refrigerant gases used in HVAC and refrigerant systems may also leak.

Forecast fugitive emissions are estimates based on a combination of Prelude operational inputs (such as average gas composition and feed gas volumes) together with NGER determination emission factors. Actual fugitive emissions are measured at Prelude in line with OGMP 2.0 Level 4 requirements as part of a leak detection and repair program. Quantified rates are reported for leaking components, while non-leaking components are also considered through calculations based on component type, component register counts and the facility's utilisation rate. For leaking components, fugitive emissions are reported internally with OGMP derived emission factors, while for external regulatory reporting, fugitive emissions are based on NGER determination emission factors as NGER does not yet consider OGMP derived data.

9.12.4.5 Non-routine Venting

If the flares are extinguished (flame-out), the hydrocarbon gas discharged via the flare system may initially not be combusted during the period required to purge the flare and re-establish flare ignition.

Between 2018 and 2024, there were a total of 49 flare flame-out events on Prelude that were not immediately reignited. These events resulted in the venting of approximately 1,400 t of CO_2-e, which is equivalent to 0.014% of the total GHG emissions over that period. These flame-out events are unplanned and therefore are not forecast. The scale of the events is considered negligible relative to overall emissions.

In 2023/24, a detailed causal investigation was undertaken to identify the causes of the flame-out events and the corrective actions to prevent such events and minimise venting duration. A long-term action plan for the reinstatement of the monitoring and ignition systems has been developed and was submitted to NOPSEMA in February 2024, with the work scheduled for the next flare outage (currently the 2030 turnaround). In the interim, flame-out monitoring occurs through the use of a thermal cameras and ignition is provided by the FFG.

9.12.4.6 GHG Abatement

Options to reduce GHG emissions and improve energy efficiency are identified through a facilitated GHG Abatement Workshop conducted each year as a requirement of the GHGEM System, which includes the development of an GHGEMP (further described in Section 10.7). The annual GHG abatement workshop and assessment process provides a detailed assessment of additional emission reduction opportunities, including reviews of Best Available Technologies, to ensure that GHG emissions are reduced to ALARP on an ongoing basis. The GHG abatement opportunities identified may be either operational improvements or capital projects. Outputs include a list and description of identified abatement opportunities, high level technical feasibility screening of the opportunities, the estimated cost of such opportunities and abatement volume estimates. Ideas for GHG abatement opportunities may also be raised during Daily Surveillance Review (DSR) meetings, at the Fuel and Flare Forum, or by the workforce at any time through the Manage Threats and Opportunities (MTO) process (refer Section 10.5.14).

Integrated GHG targets, including abatement targets, for the Prelude FLNG are established on an annual basis as part of OP process and are incorporated into the annual review of the GHGEMP. Tracking of performance against the abatement target is then undertaken through the monthly Fuel and Flare Forum (see EPS 10.8).

In the previous revision of the EP a commitment was made to implement GHG abatement projects from 2021 that would result in at least 250 ktCO_2-e in reduced or avoided emissions by 2025 with at least 100 ktCO_2-e occurring by the end of 2021. Table 9-96 shows the abatement targets versus the abatement achieved annually from 2021 to 2025 which demonstrates that each year targets were exceeded, with a total abatement of 549.8 ktCO_2-e, more than double the 250 ktCO_2-e committed to.

Table 9-96: GHG Abatement Targets vs Abatement Achieved 2021-2025

Year	Abatement Target (ktCO2-e)	Abatement Achieved (ktCO2-e)
2021	90	304
2022	59	77.35
2023	59	78.26
2024	20	44.69
2025	10.9	45.5
Total	238.9	549.8

After successfully achieving steady state operations, including high reliability, availability and utilisation, and implementing a number of major abatement projects, the opportunities for further significant reduction in GHG emissions are now limited and are focussed on increasing energy efficiency and reducing combustion emissions during stable operations. Other opportunities maybe identified opportunistically, or are likely to be influenced by future development of new technologies. Through the ongoing application of the GHGEMS and regular reviews of operational performance, Prelude will continue its journey of identifying, evaluating, and implementing various GHG reduction projects and initiatives, including consideration and incorporation of new climate and emissions related information, as well as advances in emission reduction technologies. For 2026 the GHG abatement target is set at 7.9 $ktCO_2$-e.

9.12.5 Indirect GHG Emissions (Scope 3)

Indirect emissions associated with the activity include those outside the operational control of the Prelude joint venture partners including from:

- Fuel use and combustion from infield transport activities (marine vessels and aviation) (Section 9.12.5.1).
- Fuel use, combustion and processing emissions from the value-adding product supply chain, transport and third-party end-use by Shell Group's53 customers once exported from the Prelude FLNG facility (Section 9.12.5.2).

9.12.5.1 Fuel Use for Infield Marine Vessels and Aviation (Scope 3)

Indirect GHG emissions from fuel used for power generation and transport include:

- Marine vessels will transfer goods and materials to the facility and may be required for rescue, maintenance, IMR and other surveillance activities.
- Helicopters are used to mobilise personnel to the facility with a four-hour return flight. Helicopters are also used for shipping freight to and from the facility.

To ensure conservatism, the forecast for the period of this EP is a constant value based on the peak demand for the preceding 5 years. This equates to ~0.225 $MtCO_2$-e over 5 years (average 0.045 $MtCO_2$-e), where ~80% of emissions are attributable to marine vessels (~20% aviation) (Table 9-92). Over the lifecycle, the total is ~0.765 $MtCO_2$-e with the same average and proportional contributions (given for the purposes of this EP it is assumed to be a constant).

[53] The Shell Group consists of Shell plc and all companies in which Shell plc either directly or indirectly has a controlling interest (Shell companies). Each Shell company remains responsible for the adaptation and maintenance of its legal entity policies and corporate governance processes. Services provided or consumed vis-à-vis other companies (from within the Shell Group or third parties) are to be conducted in compliance with legal and regulatory (including tax) requirements.

9.12.5.2 Supply Chain, Transport and Third-Party End-Use (Scope 3)

Once exported from the Prelude FLNG facility, the Supply Chain, Transport and Third-Party End-Use (collectively, 'End User') indirect Scope 3 emissions by Shell Group's customers are estimated using the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard, as described in the detailed breakdown of Shell Group's 2023 Scope 3 GHG emissions[54].

Assessing these Scope 3 GHG emissions requires consideration of the likely customer markets and energy mixes. Historical sales of Prelude energy have been delivered primarily to end users in Asia. While future arrangements are uncertain (i.e. subject to change based on demand), it is assumed this will remain a correct assumption for the EP period.

These Scope 3 emissions will result from the conversion of Prelude and Crux energy to thermal, mechanical, and electrical energy, mainly through combustion in power stations primarily from customers outside of Australia using LNG for power and condensate for refining.

The total indirect (Scope 3) GHG emissions from Prelude and Crux energy production are estimated to be 63.51 $MtCO_2$-e over the EP period (average 12.7 $MtCO_2$-e) and 169.87 $MtCO_2$-e over the project lifecycle (average 9.99 $MtCO_2$-e) (Table 9-94). The proportions over the lifecycle are attributed to LNG product exports (~72%), LPG product exports (~6%) and condensate product exports (~22%) (Table 9-94).

9.12.6 Context – Domestic GHG Frameworks for Expected Third Party End Users

As Prelude and Crux energy is expected to be delivered to end users primarily in Asia, these End User GHG emissions will be accounted for in the end-use countries under their respective domestic and international GHG emissions control frameworks. It is anticipated that the primary end users are likely to include consumers in Japan, South Korea, Taiwan, China and potentially India. Each of these countries, except for Taiwan (which is not presently a member of the United Nations), has ratified the Paris Agreement and is required to publish Nationally Determined Contributions to meet their respective goals.

Prelude End User GHG emissions will therefore be considered under domestic and international GHG emissions control frameworks that require the accounting, reporting and reducing of GHG emissions occurring within their jurisdictions, including:

- South Korea: aims to reduce its GHG emissions by 53 to 61% from 2018 levels by 2035 and has a long-term goal of achieving carbon neutrality by 2050. This update to South Korea's National Determined Contribution (NDC) was announced in November 2025. The 53% reduction represents a target along the linear pathway from the base year, 2018, to the target year for carbon neutrality, 2050, while the 61% reduction reflects a more ambitious target enabled by enhanced government efforts, technological innovation and industrial transformation.[55].
- Japan: aims to reduce its GHG emissions by 60% by 2035 and 73% by 2040 from 2013 levels, aligning with global climate goals to achieve net-zero emissions by 2050. In Japan's Strategic Energy Plan, published in February 2025, it is stated that the use of LNG-fired power generation is necessary as a means of transition towards power source decarbonisation, and also to maintain and secure the thermal power supply capacity necessary for a stable supply of electricity. [56].
- China: China aims to reduce its CO2 emissions by 7% to 10% from peak levels by2035, with efforts made to achieve even better results.[57].. In 2024 China's National Development and Reform

[54] https://www.shell.com/sustainability/transparency-and-sustainability-reporting/performance-data/greenhouse-gas-emissions/_jcr_content/root/main/section_1654294871/text_625214062_copy.multi.stream/1724059220539/5ac74b121026aa654e5bff7a0be354d21385d5a3/scope-ghgemissions-summary-final.pdf

[55] The Republic of Koreas 2035 NDC.pdf

[56] 2025_strategic_energy_plan.pdf

[57] National Committee of the Chinese People's Political Consultative Conference2, "Xi announces China's 2035 Nationally Determined Contributions to beef up climate response", 25 September 2025

Commission pledged to reduce GHG emissions from its national industrial system which contributes roughly half of China's carbon GHG emissions.[58].

- India: In March 2026, India updated its Nationally Determined Contribution with a commitment to reduce its emissions intensity by 47% by 2035 (compared to 2005 levels), whilst maintaining its commitment to achieving net-zero emissions by 2070.[59]
- Taiwan: Taiwan aims to achieve net-zero carbon GHG emissions by 2050. This goal was officially announced by President Tsai Ing-wen on Earth Day, 22 April 2021. Taiwan's revised 2035 NDC targets are set at a 28% (±2%) reduction by 2030 and 38% (±2%) reduction by 2035, compared to 2005 levels[60].

9.12.7 Context – The role of LNG in the Asian energy transition

Today, fossil fuels meet more than 80% of global energy demand, with an even greater reliance in many developing countries. As the world's population grows by an estimated two billion people by 2050, and the benefits of energy are extended to the hundreds of millions who do not have it today, demand for energy will only grow. The world needs a balanced and orderly transition away from fossil fuels to maintain secure energy supplies, while accelerating the transition to affordable low-carbon solutions. Countries, sectors and energy sources will move at different speeds to decarbonise.

It is recognised in Australia and internationally that natural gas and LNG will play an important role in the energy transition. The final text adopted by delegates at COP28 reinforces the role of natural gas in the global energy transition, and in particular, the recognition that '*transitional fuels can play a role in facilitating the energy transition while ensuring energy security*'.[61] Additionally, the IEA now believes that gas demand will grow into the 2030s under both the Current Policies Scenario (CPS) and Stated Policies Scenarios (STEPS) in its World Energy Outlook 2025[62].

The Australian Government's own Future Gas Strategy recognises that "*Australian gas will play an important role in an orderly global and domestic energy transformation*".[63] As identified in the Australian Government Future Gas Strategy Analytical Report, "*many Asian economies view gas as a crucial component of their pathway towards net zero. Even in the most ambitious decarbonisation scenario, gas is expected to play a role in economic activity and energy security through to 2050…Beyond providing energy security, access to gas can also promote a smoother energy transition within the region – by offering a flexible power source to complement renewable power, and by replacing heavier-emitting coal*".[64]

These forecasts are supported by the official positions of the current and anticipated end users of Prelude and Crux energy in Asia. Each of these countries has made public statements as to their anticipated use of gas and LNG into the future in support of their respective energy transition plans:

- South Korea: South Korea remains committed to the long-term goal of achieving carbon neutrality by 2050 and has set interim targets for renewable energy expansion. However LNG remains an important fuel source for power generation, industrial feedstock and increasingly as a bridge fuel in the country's complex energy transition, with the IEA noting South Korea as a key market in its Asia gas demand forecasts.[65]
- Japan: In Japan's Strategic Energy Plan, published in February 2025, it is stated that the use of LNG-fired power generation is necessary as a means of transition towards power source decarbonisation,

[58] STATEMENT: China Releases New Climate Commitment Ahead of COP26 | World Resources Institute

[59] Cabinet approves India's Nationally Determined Contribution (2031-2035) to be communicated to the United Nations Framework Convention on Climate Change | Prime Minister of India, 25 March 2026

[60] NDC3.0英文稿_淨零臺灣版

[61] United Nations Framework Convention on Climate Change, Outcome of the first global stocktake, page 5.

[62] World Energy Outlook 2025

[63] Future Gas Strategy | Department of Industry Science and Resources

[64] Future Gas Strategy Analytical Report, May 2024, pages 55-56.

[65] World Energy Outlook 2025

and also to maintain and secure the thermal power supply capacity necessary for a stable supply of electricity.[66]

- China: Even though China is prioritising renewable energy sources and domestic energy security, LNG will continue to play a role in China's energy mix, with the IEA projecting that the demand for LNG will continue to grow into 2035.[67]
- India: The Indian Government has publicly confirmed its target of increasing the share of natural gas in India's total energy mix from 6.7% in 2023 to 15% by 2030.[68]

The IEA forecasts that most of the world's future gas demand will come from the Asia-Pacific region, led by China, India and Southeast Asia.[69] This is largely driven by Asian economic growth, the need to decarbonise heavy industry and transport, and the emerging growth in the energy-intense technology sector, with LNG becoming a cost-effective fuel for shipping and road transport that can help bring down emissions.

This aligns with the basis for Shell's forecasted demand for gas and LNG into the future (see Figure 9-14). Shell sees LNG as facilitating, not replacing, the rapid growth of renewables in emerging markets. LNG growth is not in competition with renewables but supports the energy transition by providing the flexibility and stability the power grid needs with the rapid growth of renewable energy. As wind and solar power generation grows, power systems need flexible, dispatchable supply to help manage generation variability and seasonal demand.

LNG is a versatile energy source that can be used in power generation, industry, heating and transport. Further, Shell's current and future LNG portfolio has, and is projected to have, one of the lowest carbon intensities in our industry.

Prelude and Crux energy is therefore anticipated to play a critical role in supporting its customers' commitments and plans to decarbonise through the energy transition, supporting both the growth of renewables and the provision of energy security.

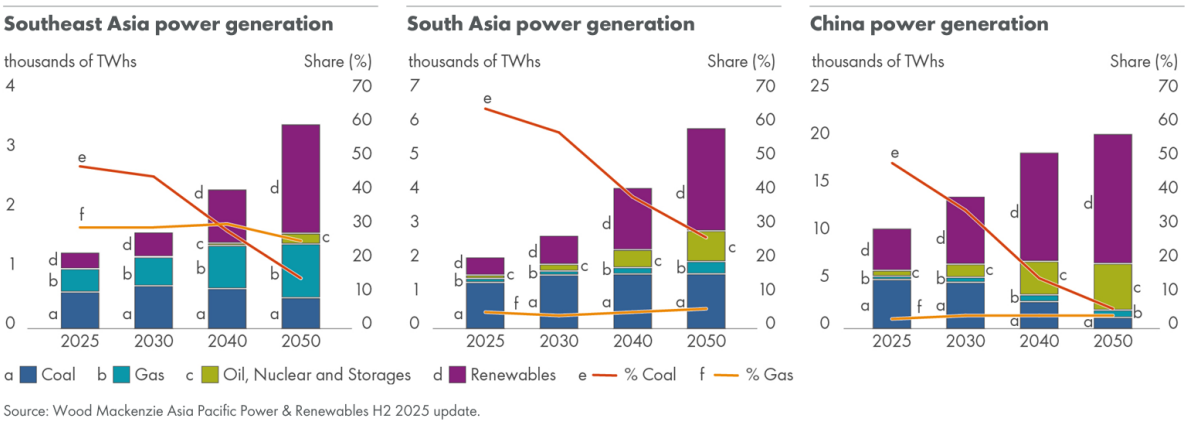


Figure 9-14: Power generation growth in major LNG import markets[70]

9.12.8 Description and Evaluation of Impacts

9.12.8.1 Prelude's Contribution to Australian and Global Greenhouse Gas Concentrations

Table 9-97 presents the estimated CO_2-e emissions for the Activity and contributions compared to the most recent CO_2-e emissions estimates for Australia and globally.

[66] 2025_strategic_energy_plan.pdf

[67] World Energy Outlook 2025, page 391.

[68] Press Release:Press Information Bureau

[69] World Energy Outlook 2025, pages 161-162, 214-217.

[70] LNG Portfolio - Strategic Spotlight 2026

Table 9-97: GHG Emissions National and Global Inventories

GHG Emissions Data Source	Total (~$MtCO_2$-e)	Estimated Scope 1 Emissions Average (~$MtCO_2$-e)[71]	Estimated Total Scope 3 Emissions (~$MtCO_2$-e) [71]	Estimated Total Emissions for the Lifecycle (~$MtCO_2$-e) [71]
Per Year Basis				
DCCEEW Paris Agreement GHG Inventory (2023)[72]	453.5 p.a.	2.245 p.a. (0.5% of total)	N/A	N/A
Total UNFCCC 2035 Baseline Scenario (2025)[73]	321.17 p.a.	2.245 p.a. (0.7% of total)	N/A	N/A
UNFCCC Annex 1 Parties (2021)[74]	15,400 p.a.	2.245 p.a. (0.015% of total)	9.99 p.a. (0.06%) of total	12.24 p.a. (0.08% of total)
IEA Global GHG Estimate (2025)[75]	37,800 p.a.	2.245 p.a. (0.006% of total)	9.99 p.a. (0.03%) of total	12.24 p.a. (0.03% of total)
Budget over				
IEA World Energy Outlook Net Zero by 2050 Budget (Average 2025 to 2035)[76]	28,000 p.a.	2.245 p.a. (0.008% of total)	9.99. p.a. (0.04%) of total	12.24 p.a. (0.044% of total)
Australian NDC GHG Budget to 2030 (2022)[77]	4,381	35.916 (0.82% of total)	N/A	N/A
IPCC AR6 Working Group (2021) Global GHG budget to meeting 2 Deg C scenario (67% likelihood)[78]	1,150,000	35.916 (0.003% of total)	169.87 (0.015% of total)	205.79 (0.018% of total)
IPCC AR6 Working Group (2021) Global GHG budget to meeting 1.5 Deg C scenario (50% likelihood)[78]	500,000	35.916 (0.007% of total)	169.87 (0.034% of total)	205.79 (0.041% of total)

Total lifecycle GHG emissions are estimated to be ~205.79 $MtCO_2$-e (Table 9-95), of which ~35.916 $MtCO_2$-e (average 2.245 $MtCO_2$-e) are direct emissions that originate in Australia. For the purposes of comparison, assuming Scope 1 emissions were split evenly across operational years, the ~2.245 $MtCO_2$-e per annum (Table 9-91) are equivalent to ~0.5% of national Australian emissions and ~35.916 $MtCO_2$-e total lifecycle emissions are equivalent to ~0.003% of global GHG emissions (Table 9-97).

[71] For detailed assumptions that underpin Crux and Prelude data, refer to Table 9-95.

[72] Source: DCCEEW May 2025 (National Greenhouse Inventory Report 2023) & UNFCCC/Paris Agreement inventory | ANGA & Australia's 2025 Paris Agreement Emissions Accounting - World Energy Data.

[73] Source: DCCEEW 2025 (National Greenhouse Accounts 2023). Total UNFCCC 2035 Baseline Scenario. Baseline scenario | ANGA.

[74] Source: UNFCCC Annex 1 Parties 2021. Without land use, land-use change, and forestry.

[75] Source: CO2 Emissions – Global Energy Review 2025 – Analysis - IEA.

[76] Net Zero by 2050 – Analysis - IEA. https://www.iea.org/data-and-statistics/charts/global-energy-related-co2-emissions-in-the-net-zero-pathway-and-low-international-cooperation-case-2010-2090.

[77] Australian Government Australia's Nationally Determined Contribution Communication 2022.

[78] IPCC AR6 (Working Group I, 2021).

The estimated incremental contribution of GHG emissions from the Activity will not materially or substantially contribute to either Australia's GHG emissions or global GHG emissions and are considered to be de minimis given:

- Scope 1 emissions:
  - are equivalent to less than 0.5% and 0.006% of Australian and global annual GHG emission inventories, respectively
  - on a forward-looking basis are equivalent to less than 0.82% of the Australian carbon budget for 2020–2030.
- Scope 2 emissions are not expected from the Activity.
- Scope 3 emissions are equivalent to less than 0.03% of global GHG emission inventories.
- Total GHG emissions, on a forward-looking basis, are equivalent to less than 0.044% of the global GHG emissions in the IEA's 'Announced Pledges' scenario and the highly stretching 'Net Zero by 2050' scenario.

9.12.8.2 Potential Impact of Climate Change

The international scientific community views GHG emissions as contributors to climate change, primarily through global temperature increases. Shell recognises the existence of climate change and that GHG emissions, which include CO_2, contribute to climate change. Shell also acknowledges that urgent action is required to address climate change.

Climate change is caused by the net global concentration of greenhouse gases in the atmosphere, with human-caused climate change impacts being a consequence of the cumulative effect of more than a century of net GHG emissions from energy use, land use change, lifestyle patterns of consumption, and production (IPCC 2023). Although it is possible to quantify the GHG emissions associated with the Activity (as described in Section 9.12.8.1) it is well-established that GHG emissions rapidly diffuse and commingle in the atmosphere. Further, the GHG emissions arising from the Activity will be *de minimis* in the context of total global and Australian emissions. As such, it is not possible to attribute the physical effects of climate change on Australian environmental values and sensitivities to a particular Activity given such effects arise as a result of cumulative global GHG emissions.

Table 9-98 indicates the key protected areas, environmental features, and values and sensitivities that may be potentially affected by climate change caused by global GHG emissions. It is intended that the receptor 'Australian Environment' is used to encompass the other receptors collectively, with this broad definition employed to incorporate the precautionary principle, acknowledging the inherent uncertainties that exist in relationships such as the effects of climate change (see Section 7.4.2). For consistency, only those receptors identified as being potentially affected are then carried forward into Section 9.12.11. An evaluation of the potential physical effects of climate change on sensitive receptors, including MNES within Australian jurisdictions, is provided in Section 9.12.8.3 for contextual purposes only.

Table 9-98: GHG Emissions: Receptor Impact Screening Summary

	Protected Areas			Features															Values and Sensitivities																							
				Physical		*Natural*				*Socioeconomic*								*Heritage and Cultural*			*Physical*				*Natural*								*Socioeconomic*							*Heritage and Cultural*		
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect																																									

Legend:		
		Potentially affected
	*	Predicted impact

9.12.8.3 Physical Features, Natural Values and Sensitivities and Protected Areas

As described above, it is not possible to attribute the physical effects of climate change on Australian environmental values and sensitivities to a particular Activity given such effects arise as a result of cumulative global GHG emissions.

The overview presented below is therefore for contextual purposes only, and describes the potential physical effects of climate change on sensitive receptors, including MNES within Australian jurisdictions. Noting that it is not a comprehensive list, as it is not practical to identify, describe and demonstrate acceptability for all environmental values and sensitivities in Australia that may be impacted by climate change.

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change and finalised the Sixth Assessment Report (AR6) in 2023 (IPCC 2023)[79]. A summary of outcomes of the AR6 Working Group's contributions comprises a range of matters, which amongst others include:

- The AR6 Working Group I (AR6-WG1) report stated that it is unequivocal that there is human-induced warming. It also stated that increased atmospheric CO_2 levels, generated by human activity, are the largest driver of warming over the longer term, and that there are a range of factors, including emissions of CH_4, which increase warming in the short-term.
- The AR6 Working Group II (AR6-WG2) report noted that societal choices and actions implemented in the next decade will determine the extent to which medium and long-term pathways will deliver climate resilient development.
- The AR6 Working Group III (AR6-WG3) report provided an updated global assessment of climate change mitigation progress and pledges and examined the sources of global emissions. It explained developments in emissions reduction and mitigation efforts and assessed the impact of national climate pledges in relation to long-term emissions goals. More than 2000 quantitative emissions pathways were submitted to the IPCC, of which 1202 scenarios included sufficient information for assessing the associated warming.

The IPCC (2023) estimates that using the global Nationally Determined Contributions (NDCs) committed by 2030 may result in a temperature increase of 1.5 °C in the first half of the 2030s and a 2.8 °C [2.1–3.4 °C] median temperature rise by the end of the century (medium confidence).

The IPCC AR6-WG2 report identified climate risks for natural values in the Australasian region. Similar risks were also been identified by the Australian Government in 2022 including:

- loss and degradation of coral reefs and associated biodiversity and ecosystem service values in Australia due to ocean warming and marine heatwaves
- loss of alpine biodiversity in Australia due to less snow
- transition or collapse of alpine ash, snowgum woodland, pencil pine and northern jarrah forests in southern Australia due to hotter and drier conditions with more fires
- loss of kelp forests in southern Australia due to ocean warming, marine heatwaves, and overgrazing by climate driven range extensions of herbivorous fish and urchins
- loss of natural and human systems in low-lying coastal areas due to sea level rise
- disruption and decline in agricultural production and increased stress in rural communities in south-western, southern, and eastern mainland Australia due to hotter and drier conditions
- increase in heat-related mortality and morbidity for people and wildlife in Australia due to heatwaves
- cascading, compounding and aggregate impacts on cities, settlements, infrastructure, supply-chains, and services due to wildfires, floods, droughts, heatwaves, storms, and sea level rise
- inability of institutions and governance systems to manage climate risks.[80].

[79] This consists of three Working Group contributions and a Synthesis Report.

[80] DCCEEW, Australia state of the environment 2021.

The IPCC reports that the global mean sea level has increased by 0.20 m between 1901 and 2018 (IPCC 2023). The IPCC (2023) predicts that it could rise between 0.15 m and 0.29 m further by 2050[81] (medium confidence), leading to coastal inundation and habitat loss. This may affect mangroves, offshore islands, salt marshes, and coastlines (Ward et al. 2016). Increased CO_2 absorption by oceans and freshwater bodies raises water acidity impacting aquatic organisms (Steffen et al. 2009).

Australia's average sea surface temperature has warmed by more than 1 °C since 1900 (IPCC 2023). Marine heatwaves are more frequent and intense (Ruthrof et al. 2021) threatening marine community structure and coral bleaching events (BOM and CSIRO 2024). Coral reefs could decline by a further 70–90% at 1.5 °C of global warming (high confidence) (IPCC 2023).

The IPCC (2023) predicts that near-term risks for biodiversity loss as a result of global climate change are moderate to high, especially in kelp, seagrass, and warm-water coral reefs (high to very high confidence). These changes undermine the coral reef's ability to support marine life. (Hoegh-Guldberg et al. 2018).

Table 9-99 lists species and associated EPBC publications that recognise climate change as a potential risk to the receptor and describes the potential impacts to key animal groups.

Table 9-99: Overview of Potential Climate Change to Taxa

Taxa	Potential Impacts
Marine Mammals	Marine mammals most sensitive to climate change generally show marked feeding and habitat specialisation (Albouy et al. 2020). The EPBC publications that recognise climate change as a potential threat relevant to marine mammals are associated with whales (blue, fin and sei). Whales may also be affected by climate change through changes in distribution and abundance of their prey (CoA 2015a; WWF n.d.a). Changes in ocean temperatures, upwellings, acidification, and melting Antarctic Sea ice may impact krill availability, the major food source for these whales (CoA 2015a; DoE 2015c; TSSC 2015b). Climate change may also affect their migratory timing, habitat occupancy, breeding schedules, reproductive success, and survival (van Weelden et al. 2021).
Marine Reptiles	The EPBC publications that recognise climate change as a potential threat to marine reptiles are associated with marine turtles and the dusky sea snake. Climate change may alter turtle dispersal patterns, food webs, species range, primary sex ratios, habitat availability, reproductive success, and survivorship (CoA 2017b). Possible impacts to marine turtles include increased air temperatures (altered embryo development) and increased sea levels rise (nesting beach stability and foraging ground distributions) (TSSC 2008a). Climate change and severe weather, including frequent and severe heatwaves; high average water temperatures; and severe cyclones and storms are identified as threats to the dusky sea snake. These threats can result in the reduction of dusky sea snake habitat, caused by marine heatwaves, ocean acidification, coral bleaching and increased wave action. Higher water temperatures can also periodically create lethal thermal conditions for the dusky sea snake (DCCEEW 2024l).

[81] Relative to 1995–2014

Taxa	Potential Impacts
Sharks, rays, and other fish	The EPBC publications that recognise climate change as a potential threat to sharks, rays and other fish are those associated with sharks (namely whale sharks and white sharks). Most sharks and rays are ectothermic, with their biology and metabolism influenced by the ambient water temperature. Ocean temperature directly affects physiological and metabolic functions in sharks, including digestion, growth, and reproduction. Warmer water decreases oxygen solubility, increasing metabolic rates and thereby limiting oxygen availability (Pearce 2022). Climate change may also affect whale sharks through changes in prey distribution and abundance. As ocean water warms, juvenile whale sharks may shift their range and feeding aggregation locations to follow prey (WWF 2024; Grose et al. 2020).
Birds	Numerous EPBC publications recognise climate change as a potential threat to shorebirds and seabirds. Climate change may cause advanced spring migration, changes in habitat, higher disease transmission, earlier egg-laying time, reduced food availability, and population decline (Xiaohan et al. 2022).

The State of the Climate Report 2024 (jointly produced by the Bureau of Meteorology (BOM) and CSIRO) observed the following impacts of global climate change on the Australian physical environment, such as (but not limited to):

- Australia's climate has warmed by an average of 1.51 ± 0.23 °C since national records began in 1910
- Sea surface temperatures have increased by an average of 1.08 °C since 1900
- The warming has led to an increase in the frequency of extreme heat events over land and in the oceans
- Heavy short-term rainfall events are becoming more intense
- There has been an increase in extreme fire weather, and a longer fire season, across large parts of the country since the 1950s
- Oceans around Australia are becoming more acidic, with changes happening faster in recent decades
- Sea levels are rising around Australia, including more frequent extreme high levels that increase the risk of inundation and damage to coastal infrastructure and communities.[82]

The State of the Climate Report 2024 forecasts that Australia may experience ongoing changes to its weather and climate, such as (but not limited to):

- Continued increase in air temperatures, with more heat extremes and fewer cold extremes
- More intense short-duration heavy rainfall events even in regions where the average rainfall decreases or stays the same
- Continued increase in the number of dangerous fire weather days and a longer fire season for much of southern and eastern Australia
- Further sea level rise and continued warming and acidification of the oceans around Australia
- Fewer tropical cyclones, but with higher intensity on average, and greater impacts when they occur through higher rain rates and higher sea level.

The North-West Marine Parks Network Management Plan 2018 (DNP 2018a) identifies climate change as a pressure that may impact marine park values. The management plan states that impacts of climate change on the marine environment are complex and may include changes in sea temperature, sea level, ocean acidification, sea currents, increased storm frequency and intensity, species range extensions or local extinctions, all of which have the potential to impact on marine park values (DNP 2018). Within the Marine

[82] State of The Climate 2024

Bioregional Plan for the NWMR (DSEWPaC 2012), pressures related to climate change are assessed as 'of potential concern' for species of marine turtle, inshore dolphins, sawfish, sea snakes, whale shark, dugong, and seabird and shorebird, as well as the KEFs and shipwrecks known to occur in the NWMR.

Climate variability and change has been identified as a risk to some EPBC Act protected species, including marine turtles, whales, seabirds, and migratory shorebirds (CoA 2017b, CoA 2015a and CoA 2022). The Australian Marine Parks – North-west Marine Parks Network Management Plan 2018 (DNP 2018a) considers the effects of climate change and the potential impact on marine park values such as habitats, KEFs and marine fauna species. The management plan acknowledges that the potential impacts of climate change on the marine environment are complex and may include changes in sea temperature, sea level, ocean acidification, sea currents, increased storm frequency and intensity, species range extensions, or local extinctions. These changes have the potential to impact marine park values (DNP 2018a).

In the Marine Bioregional Plan for the NWMR (DSEWPaC 2012), climate change-related pressures are assessed as 'of potential concern' for various species and features, including marine turtles, inshore dolphins, sawfish, sea snakes, whale sharks, dugongs, seabirds, and shorebirds, KEFs and shipwrecks that may occur in the NWMR.

Coral reefs were recognised by both IPCC and the Australian Government as being at risk of climate change.[83] Protected coral reef areas in Australia include those within World Heritage listed sites, such as Ningaloo Coast, Shark Bay, or the Great Barrier Reef. Climate change has been identified as a threat for each of these World Heritage areas, with potential risks to coral reef as well as other environmental values (such as marine fauna) within these ecosystems (IUCN, 2020b, 2020c, 2020a).

9.12.9 Impact Assessment Summary

While there are observed and predicted physical effects of climate change to Australian environmental values and sensitivities, such impacts cannot reasonably be attributed to a single activity's GHG emissions. Although it is possible to quantify the GHG emissions associated with the Activity it is well-established that GHG emissions rapidly diffuse and commingle in the atmosphere. Further, the GHG emissions arising from the Activity will be *de minimis* in the context of total global and Australian emissions. As such, it is not possible to attribute the physical effects of climate change on Australian environmental values and sensitivities to a particular Activity given such effects arise as a result of cumulative global GHG emissions. Shell has therefore assessed that there is no impact to the overall consequence level reasonably expected. While this is considered to be an acceptable level, it will nevertheless manage GHG emissions and any potential impacts to ALARP.

Table 9-100 lists the highest residual impact consequence ranking of the relevant environmental receptor groups.

Table 9-100: GHG Emissions Evaluation of Residual Impacts

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Evaluation – Planned Impacts			
Protected Areas	0	M	No impact to the overall consequence level reasonably expected.
Physical Features	0	M	No impact to the overall consequence level reasonably expected.
Physical Values and Sensitivities	N/A	N/A	N/A
Natural Features	N/A	N/A	N/A
Natural Values and Sensitivities	0	M	No impact to the overall consequence level reasonably expected.

[83] DCCEEW, Australia state of the environment 2021.

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Socioeconomic Features	N/A	N/A	N/A
Socioeconomic Values and Sensitivities	N/A	N/A	N/A
Heritage and Cultural Features	N/A	N/A	N/A
Heritage and Cultural Values and Sensitivities	N/A	N/A	N/A

9.12.10 ALARP Assessment and Environmental Performance Standards

Table 9-101: Greenhouse Gas Emissions - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	Use of renewable energy (e.g. solar, wind and wave) in lieu of fossil fuels for power generation and marine vessel propulsion	No	Renewable energy sources like solar, wind, and wave lack the reliability needed for continuous operations and require extra space and capital. Additionally, renewable technology for a full offshore processing facility is neither available nor proven.	N/A	N/A	N/A
Elimination	Reinject the acid gas into an appropriate geological formation	No	Based on a comprehensive assessment, no technical and/or economically viable solution was identified for re-injection due to: • Lack of a contained and confined geological formation to effectively contain and seal the injected acid gas stream. Recirculation of the CO_2 through leakage back into production fluids leading to material compatibility issues was found to be a possible outcome of reinjection in the available geological strata. • Re-injection would have resulted in extra equipment onboard the FLNG Facility (CO_2 compression, dehydration, extra steam boiler), leading to additional sources of safety risk, emissions, congestion and maintenance requirements. CO_2 re-injection would also have required a considerable monitoring (including 4D seismic) and reporting effort to comply with Government legislation on carbon capture and storage, which could have introduced a new range of environmental, safety and operability hazards.	N/A	N/A	N/A
Substitution	Use of electric motor drivers or aero-derivative GTs	No	As part of the FLNG feasibility studies for Prelude a number of power generation options were considered. As part of this assessment of options, gas turbines were rejected as the risk of a gas turbine blade failure was considered too high to allow operation of gas turbines above LNG tanks. Electric drivers were also rejected as the footprint required was significant and required the use of 66kV distribution which is not approved for marine use by the IMO. Combined cycle was also considered but was not found to be sufficiently electrically stable, particularly in upset and start-up conditions. This lack of stability would have resulted in lost production and extended flaring leading to more atmospheric pollutant and GHG emissions. Thereby negating the energy efficiency benefits achieved through the application of Gas Turbines. Steam turbines were the option selected. Seven steam boilers generate sufficient steam to drive the main compressors and supply 120 MW. While less energy efficient, resulting in an 8% fuel use increase, it is a more robust and reliable option in terms of equipment reliability. The complexity, large footprint required, and the significant impact to production that would be required to retrofit the system at this stage of operations is considered to be grossly disproportionate to any reduction in emissions that might be realised from less fuel gas use, and is therefore not ALARP.	N/A	N/A	N/A
Engineering	Use of a battery energy storage solution system to supplement power generation.	No	The size and weight of the battery system needed to provide equivalent 'spinning reserve' and to ensure a continuous uninterrupted power supply for safe operations renders the opportunity infeasible.	N/A	N/A	N/A

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Engineering	Flare gas recovery system.	No	There would be significant additional cost associated with the design and installation of flare gas recovery systems, including significant retrofitting of multiple stages of compression systems, coupled with associated ancillaries, valving and piping, platform modification and space and weight considerations. The environmental benefit gained from the recovery of flaring emissions would be limited to only a portion of flare system flows due to process safety constraints and flare system operation over a wide design envelope (associated with flow and pressure variations and related flowline integrity management). Furthermore, required retrofitting of multiple stages of compressions (e.g. for LP/HP streams) would offset any environmental benefits through increased power generation emissions. The retrofitting interaction with the safety critical flare system and continued operation of gas compression would also increase platform safety risks. Given the increased safety risk and the very low, if any, environmental benefit provided when increased power generation emissions are taken into consideration, the installation of flare gas recovery systems is considered grossly disproportionate to the environmental benefit it would provide.	N/A	N/A	N/A
Engineering	Recycle excess fuel gas during loading through installation of a BOG compressor.		While technically feasible the installation of a BOG compressor would only result in minimal GHG reduction (between 1-2 ktCO_2-e per year). However the significant CAPEX required to implement this option is considered grossly disproportionate to the environmental benefit it would provide.	N/A	N/A	N/A
Engineering	Increasing the steam system pipe class above 900 pounds (U63000)	No	Increasing the temperature and pipe class above 900 pounds in the steam system would significantly reduce the amount of energy input required for the system. However, increasing the pipe class above 900 pounds would mean much higher CAPEX, weight of piping and HSE risks. The sum of these costs was considered, and remains grossly disproportionate to the possible benefits in energy efficiency that could be achieved.	N/A	N/A	N/A
Engineering	Decrease the condensing pressure of steam to below 200 mbar (U63000)	No	Although the condensing pressure of the condensing steam turbines is at the lowest that can be achieved with the designed cooling system, further efficiencies could be achieved by increasing the size of the cooling system. However, this would be a significant change in the cooling system and was rejected because further study costs were considered too high at the time of design.	N/A	N/A	N/A
Engineering	Increase thermal efficiency of the boilers	No	An opportunity was raised during design to consider maximising the Thermal Efficiency of Boilers. On investigation, it was found that the boilers' thermal efficiency could be increased from 90% to 93% by increasing the size of the economisers. Increasing the thermal efficiency above 93% would require additional equipment meaning a significant increase in size, weight and cost and hence increasing the efficiency above 93% was rejected early in the investigation. A financial assessment was then carried out, which demonstrated a net benefit to increasing the efficiency from 90 to 93%. However, to obtain this increase in efficiency it is necessary to reclaim a greater amount of energy from the exhaust gas. This was found to lead to an increase in the risk of acid corrosion of the flue gas system	N/A	N/A	N/A

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			occurring when operating on diesel (from sulphuric acid in diesel exhaust). This risk was considered significant enough to reject the opportunity and maintain the design efficiency at 90%.			
Engineering	Change all electrical motors >1 MW to VSD.	No	An opportunity was identified to consider changing all large motors (over 1 MW) to Variable Speed Drivers (VSD) in order to increase their efficiency in reacting to low flows. Although, it has been registered as 'rejected' on the basis that not all large motors are fitted with Variable Speed Drivers, it could be considered as partly implemented as those large motors where a significant benefit in applying variable speed exists have been changed to steam turbines. The MEG Recycle Pumps, Overhead Compressor Driver and Endflash Compressor Driver are all Steam Turbines in the design. Other pumps over 1 MW have minimal variation in flow, so there is little benefit in making them variable speed.	N/A	N/A	N/A
Engineering	Replace boilers with cogeneration combined cycle.	No	The Prelude FLNG heat and power system is based on boilers and steam turbines as opposed to a Co-Generation or Combined Heat and Power plant. This decision has the biggest individual impact on GHG output with Combined Heat and Power Plants up to 1/3 more efficient than boiler based systems. However, at the time of design, Co-Generation and Combined Heat and Power were relatively new technologies and were considered to carry significant technology risks. Given the level of technical novelty already incorporated into the FLNG design, the costs in terms of risks were considered grossly disproportionate to the benefits in energy efficiency that could be achieved at the time of design, and remain so in the context of retrofitting the existing heat and power system.	N/A	N/A	N/A
Engineering	Flow meters and indicators for measuring GHG emissions including: • Flare flow meters; • Vent flow meters; • Boiler flow meters; and • Product export level indicators are maintained in accordance with the CMMS as detailed in Section 10.5.8 and 10.5.9.	Yes	Flare flow meters, upstream of the actual flare boom, are maintained according to the maintenance schedule and maintenance system to verify they are within reliability, availability and accuracy requirements for this equipment.	10.1	The following emission monitoring equipment are categorised as ECEs: • Flare flow meters; • Vent flow meters; • Boiler flow meters; and • Product export level indicators are prioritised, maintained and confirmed to be functional in accordance with the CMMS.	CMMS maintenance records.
Engineering	Installation of an igniter on the maintenance vent to minimise GHG emissions when the flare system is not operational.	Yes	During normal operations there are no practically feasible ways to conduct maintenance on the operating flare system as the pilot flare is ignited all the times. The flare system is maintained according to the CMMS which allows for maintenance during certain shutdown events when the flare system is not operational. The maintenance vent is designed to be used as flare relief when the flare undergoes maintenance to safely discharge of boil-off gas. The flare system was first taken out of service for maintenance during the 2023 turnaround, with the system unavailable for a	10.2	The maintenance vent igniter project will be implemented in accordance with the Shell Brownfields Management Manual which includes the following phases and timelines: • Select Phase Completion – May 2026 • Define Phase Completion - March 2027 • Ready for Implementation – March 2028 • Implementation Start – April 2030 (pre-turnaround 2030) • Ready for Start-Up (RFSU) – May 2030	Records demonstrate compliance with the Project milestones in accordance with the Brownfields Management Manual.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			period of 40 days. Approximately 118,000 tCO_2-e was released from the maintenance vent during this time. As part of the Flare Pilot and Ignition System – Long Term Management Plan and ALARP Demonstration (submitted to NOPSEMA in February 2025), a commitment was made to investigate the potential to implement an ignited vent for the 2030 turnaround to minimise the GHG impact and improve operational safety. A feasibility assessment was undertaken in November 2024 to explore the conversion of the maintenance vent into a temporary ignited vent system. In January 2025 the project was accepted into the Brownfields process engineering concept stream and the Select Phase Report was delivered in November 2025. The selected concept involves: • 15-meter extension to the existing vent stack. • Installation of a DN350 flare tip with two continuously operating pilots. • Use of high-energy manual igniters on each pilot (manual ignition). • LPG supply via ten offshore-rated racks (5x 45kg cylinders each) using tubing for LPG supply / pilot lines in lieu of piping (pending Technical Deviation) • Use of non-welded joints for reinstating the rainwater line (pending Technical Deviation) • Guy wire supports for the new vent • Power connection to welding socket outlets, in lieu of UPS or power distribution box • Lifting ears / trunnions on new vent to remove the need for vertical access to top of new vent • Temporary installation and full reversibility post-TA. The intent is for the igniter to be available during times when the flare is out of service for maintenance (approximately 15-30 days, every 8-12 years during turnarounds). One of the key functional requirements to be considered as part of the project is the ability to ensure reliability of the ignition system to minimise the venting of hydrocarbons to ALARP. Confirmation of the combustion/destruction efficacy of the ignitor will form part of the tender evaluation during the next phase of the project, however as the system is by design low pressure, a destruction efficiency of 98% may not be achievable. The system will, however, have two continuously lit pilots (with a high-energy manual igniter on each pilot) to provide a reliable source of ignition and monitoring of the flame will be via CCTV. In the event of a flame-out the reignition will be via manual ignition by operator within 30 mins of identification of the flame-out. The next steps of the project will follow the requirements in accordance with the Brownfields Management Manual (OPS_PRE_004044) which provides the minimum requirements for how to apply the Shell Group Opportunity Realisation Standard (ORS) and Project Standards in a fit for purpose way for Prelude Opportunities. All	10.3	The ignited vent will be installed and ready for operation for the 2030 maintenance turnaround.	Evidence of installation of the maintenance vent igniter.
				10.4	The maintenance vent ignitor will be used during periods when the flare is out of service for maintenance to prevent the venting of hydrocarbons. The ignitor will have two continuously lit pilots to mitigate the risk of flame-outs. The flame is monitored via CCTV, with any flame-out reignition via manual ignition within 30 mins of identification of the flame-out.	Records demonstrate use of the maintenance vent ignitor during periods when the flare is out of service for maintenance. The duration of any flame-out events is recorded in shift records and flame-out events are recorded in Sphera.
				10.5	A preservation strategy will be in place for the ignited vent system to maintain the integrity, operability and reliability of the system.	Copy of the Preservation Strategy and records of its implementation.

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			Brownfield activities conducted at the Prelude FLNG Facility are managed and conducted in accordance with this Manual. The current project schedule includes the following milestones: • Select Phase Completion – May 2026 • Define Phase Completion – March 2027 • Ready for Implementation – February 2028 • Implementation Start – April 2030 (pre-turnaround 2030) • Ready for Start-Up (RFSU) – May 2030 The ignited vent system is intended for temporary use during planned flare outages only. The system will therefore be designed to operate safely and effectively under these specific conditions, with all modifications reversible post-operation. A preservation strategy will be prepared as part of the project to ensure that the integrity, operability and reliability of the system is maintained between uses.			
Engineering, Administrative and Procedural	Optimised operation of the FLNG to maintain safe and reliable operations, maximise production efficiency and minimise GHG emissions through: • Reporting of GHG emissions to the Clean Energy Regulator where required by the NGER Act. • Implementation of the Greenhouse Gas and Energy Management System (GHGEMS) as detailed in Section 10.7 including: ○ Greenhouse Gas and Energy Management Plan (GHGEMP). ○ Abatement Workshop and Assessment Process. ○ OP Process (Section 10.7.2) ○ The Operations Playbook provides guidance to minimise GHG emissions during planned plant shutdowns and start-ups. ○ Methane Emissions Management process and fugitive emissions management procedure.	Yes	**NGER Act and Safeguard Mechanism** Through the design process for the Prelude FLNG facility, there are multiple design choices which have been made which assist in improving the overall efficiency of the facility. These efficiency measures drive GHG emissions reductions, that would otherwise occur, or improve the GHG intensity of production (tCO2-e/t hydrocarbon produced). The Australian Government's Safeguard Mechanism (administered under the NGER Act and Safeguard Rule) sets legislated, facility-level emissions limits ("baselines") for facilities ≥100,000 tCO_2-e/year. From 1 July 2023, baselines are production-adjusted (output-linked) and decline annually, so that facilities must improve net emissions intensity over time while accommodating legitimate changes in throughput. This structure directly incentivises operators to optimise GHG efficiency, minimise emissions, and maximise production. Compliance with the Safeguard Mechanism is therefore considered the most appropriate performance standard for the various GHG efficiency measures that are inherent in the design of the facility. As these design features were selected, installed and commissioned prior to the commencement of this EP they are not described in further detail with EPSs.	10.6	Net GHG emissions on the Prelude facility are managed to comply with the Safeguard Mechanism and reported annually to the Clean Energy Regulator, as required by the NGER Act.	Public NGER reporting records.
			GHGEMS and GHGEMP At the Shell Group level, GHG emissions management is monitored as one of the top 5 risks to Shell's business, and managing GHG emissions effectively is therefore a fundamental risk mitigation activity, with strategic and economic importance. Prelude has a GHGEM System (further described in Section 10.7), which includes a GHGEMP, which receives and incorporates key inputs from the abatement assessment and OP processes (Refer Section 10.7).	10.7	Prelude will have in place a GHGEMP, which is reviewed annually and includes the following: • An overview of what Prelude's GHG emissions are, and abatement projects being considered • GHG targets and GHG limits • GHG forecast over the life of the Prelude (and Crux when online) field/s • Demonstration of how Prelude manages GHG risk consistent with the GHGEMS (described in Section 10.7) • Methane Improvement Plan	Greenhouse Gas and Energy Management Plan. GHGEMP records demonstrate it is revised annually.

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			Shell uses GHGEMPs to manage significant sources of GHG emissions to ALARP throughout operations. The main purpose of this GHGEMP is to: • Provide an overview of what Prelude's GHG emissions are, and which abatement projects are being considered (both in and out of plan) to reduce GHG emissions to ALARP. • Establish GHG targets and set out GHG limits from external sources. • Provide GHG forecasts over the life of the Prelude field. • Demonstrate how Prelude FLNG manages GHG risk consistent within GHGEM control framework requirements and local regulatory framework. • Document Prelude's Methane Improvement Plan. The GHGEMP is reviewed annually to incorporate the regular review and optimisation processes that occur, namely the abatement workshop and assessment process and subsequent OP process, which sets out integrated GHG targets for the Prelude FLNG. The annual GHG abatement workshop and assessment process provides a further detailed assessment of additional emission reduction opportunities to ensure that GHG emissions are reduced to ALARP on an ongoing basis. Every three years, in line with the Shell Global triennial review, an assessment of previously eliminated abatement opportunities, including equipment-based controls, will be reassessed together with consideration of advances in emission reduction technologies which may be applicable. The GHG abatement opportunities may be either operational improvements or capital projects. Outputs include a list and description of identified abatement opportunities, high level technical feasibility screening of the opportunities, the estimated cost of such opportunities and abatement volume estimates. Ideas of GHG abatement opportunities can also be raised by the workforce at any time through the Manage Threats and Opportunities (MTO) process (see Section 10.5.14). After successfully achieving steady state operations, including high reliability, availability and utilisation, and implementing a number of major abatement projects, the opportunities for further significant reduction in GHG emissions are now limited and are focused on increasing energy efficiency and reducing combustion emissions during stable operations. Other opportunities maybe identified opportunistically, or are likely to be influenced by future development of new technologies. Through the ongoing application of the GHGEMS and regular reviews of operational performance, Prelude will continue its journey of identifying, evaluating, and implementing various GHG reduction projects and initiatives, including consideration and incorporation of new climate and emissions related information, as well as advances in emission reduction technologies. As described in Section 9.12.4.6, between 2021 and 2025 a confirmed abatement of 549.8 kt CO_2-e was achieved, with most	10.8	An annual abatement workshop is conducted to identify additional emission reduction opportunities, including an assessment of previously eliminated abatement opportunities and advances in emission reduction technology triennially in line with the Shell Global review. Abatement projects committed to for the year are then managed through the MTO process (described in Section 10.5.14), using the Fit 4 tool.	GHG annual abatement workshop report. Fit 4 records for abatement projects.
				10.9	Prelude facility annual GHG goals and targets (total emissions and abatements) are tracked and managed through the monthly Fuel and Flare Forum.	Fuel and flare forum meeting records.

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			initiatives focused on flare reduction and steam optimisation. For 2026 the GHG abatement target is set at 7.9 kt CO_2-e. The asset holds a monthly Fuel and Flaring Forum. This meeting, comprised of surveillance, environment, operations and production engineers, is a forum to discuss flaring performance in real terms, suggest new flaring minimisation ideas, discuss upcoming activities that could result in additional flaring and track progress on abatement opportunities and projects. This integrated approach combining daily operational scrutiny, structured forums, and targeted actions ensures continuous improvement and transparent management of flaring and venting performance.			
			The Prelude Operations Playbook includes direction to panel operators that depending on which type of trip the facility has experienced, what fuel mode to run the plant on in order to minimize total GHG emissions. The Playbook is updated periodically to optimise the start-up process and address issues which have resulted in increased emissions.	10.10	The Operations Playbook directs panel operators on what fuel mode to run the plant on in order to minimise total GHG emissions, depending on which type of trip the facility has experienced.	Records of implementation of the Operations Playbook
			Fugitive emissions, from leaks in valves, flanges, or hydrocarbon processing areas, account for less than 1% of the facility's GHG emissions. Shell Group aims to keep CH_4 emissions intensity below 0.2% and achieve near-zero CH_4 emissions by 2030. During operations, LDAR surveys will be conducted on an annual basis to identify fugitive emissions from valves, emission points, flanges, or equipment from any hydrocarbon processing and refrigerant use areas of the facility topsides. All identified fugitive emissions are recorded in the facility leak register and risk assessed for maintenance scheduling. Prioritisation of leak repairs is assessed based on a combination of factors including process safety and health risks, impairment complexity and leak magnitude, which incorporates consideration of the resulting GHG emissions. Feasibility of repair is also an important factor when assessing prioritisation of repair. For example, some leaks may require a partial or full facility shutdown to allow for repair, whilst others may be conducted on the run while the facility is operating. Repairs may be executed opportunistically during unplanned shutdowns to ensure emissions are driven towards ALARP.	9.19	Shell will annually conduct, in alignment with OGMP 2.0 requirements: • A site level LDAR survey (Level 4) encompassing all topside modules with hydrocarbon/refrigerant use and; • A source level methane quantification survey (Level 5). An annual reconciliation of OGMP Level 4 and Level 5 data will be completed, with equipment identified as leaking recorded in a leaks inventory (or equivalent), and repair carried out in accordance with the CMMS.	Records of methane emissions including: • Records of OGMP Level 4 and Level 5 completed annually and inclusive of reconciliation efforts. • Records of leak sources identified via OGMP Level 4 (LDAR with leaks quantified) added to a suitable asset leak register or equivalent. CMMS records
Engineering, Administrative and Procedural	Optimised operation of the power generation systems to minimise GHG emissions including: • The use of dual fuel HP Steam boilers which are operated on fuel gas during steady state production operations. • A surveillance program and DCS logic in place to monitor the boilers such that they are operating safely and reliably.	Yes	Fuel gas produced at Prelude, is a cleaner burning fuel in comparison to diesel and will be preferentially used during normal operations. The use of low sulphur diesel will be required only during occasional shutdown and start-up scenarios and maintenance activities such as safety function testing. Seven boilers are installed, with one ideally available as a spare. This ensures that boilers can be operated within their optimal efficiency range, avoiding inefficient, high-emission operation and unnecessary start-ups/shutdowns. Operating the boiler system within the design operating envelope and at the targeted/design efficiency provides a degree of	9.5	HP Steam boilers to operate on fuel gas during steady state production operations, or on low sulphur diesel as required during upset conditions and/or during maintenance activities	DCS shows boilers operated using fuel gas.
				9.6	To ensure the boilers are operated safely and reliably to minimise emissions, a surveillance program and DCS logic is in place to monitor the following parameters: • Excess O_2 • Flue gas temperature • Fuel to steam ratio • Air flow (or fan speed)	DCS/PI trends/data of the following parameters: • Excess O_2 • Flue gas temperature • Fuel to steam ratio • Air flow (or fan speed)

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
	• Work Execution Flow Scheme (WEFS) to assist with optimising start-up activities. • Daily connects between panel operators and surveillance engineers. • Daily Surveillance Review (DSR) and Daily Production Review (DPR) meetings. • Fuel and Flare Forum to minimise fuel demand and reduce emissions. • Maintenance of the system in accordance with CMMS defined in Section 10.5.8 and 10.5.9.		assurance that the emission levels are within the levels guaranteed by the vendor of the equipment. Parameters monitored include: • Type of fuel used – fuel gas or low sulphur diesel. • Fuel to steam ratio – design rate of 13.5 tonnes steam / tonne of fuel gas. • Air flow – air flow is dynamically controlled via maintaining an excess O_2 set point. This is cascaded via boiler-firing controls in the DCS which also compensate for the number of burners and lead-lag of the boiler (through ramp-up and ramp-down). Flow is controlled via the actuation of the force draft fan dampers. • Flue gas temperature - design temperature limit is 250ºC to manage equipment integrity and operating target of 210 ºC for energy efficiency. • Excess O2 – to improve energy efficiency the excess O2 is dynamically changed according to boiler load based on DCS logic. The continuous monitoring and surveillance of the above parameters with supporting set-points and DCS logic, ensures that operation of the boiler system is within the most reliable and safe operating mode, which in turn increases reliability and reduces emissions. The monitoring also allows for rapid detection and response to deviations, and prevents and/or minimises abnormal events (such as unplanned flaring or venting) that could significantly increase GHG output. Daily connects between the panel operators and the Surveillance Engineers are used to review performance and discuss and implement minor adjustments to ensure that the boilers are operating as safely and reliably as possible. Further detailed monitoring of performance and proposed actions are identified in the Daily Surveillance Review (DSR) meeting with implementation of any actions planned in the Daily Production Review (DPR) meeting. To further optimise efficiency and minimise GHG emissions, steam demand is minimised to reduce overall fuel demand and therefore emissions. This is achieved by utilising medium pressure steam let down from the steam turbine generator extraction. Work Execution Flow Scheme (WEFS) are also used during start-up activities to assist in optimising activities through things like sequencing and process optimisation in order to reduce emissions associated with the start-up.	9.7	Daily connects occur between the Panel Operator and the Surveillance Engineer where minor adjustments are made to ensure that the boilers are operating as safely and reliably as possible. Further detailed monitoring and any actions to improve the safe and reliable operation of the boilers are identified in the DSR and are planned for implementation in the DPR.	Evidence of actions taken from daily panel connects. Evidence of actions planned and implemented through the DSR and DPR.
				9.8	Boilers are prioritised, maintained and confirmed to be functional in accordance with the CMMS.	CMMS maintenance records.
				9.9	Fuel efficiency and steam consumption as a ratio of gas rundown is assessed in the monthly Fuel and Flare Forum to identify if steam demand has changed and to take actions (via the DPR) to minimise fuel demand and reduce emissions.	Fuel and Flare Forum meeting minutes. Evidence of actions implemented through the DPR.
				9.10	Start-up Integrated Work Execution Flow Scheme (WEFS) are implemented during start-ups to optimise fuel gas use and reduce emissions.	Records demonstrate WEFS developed and implemented, including GHG minimisation and risk management measures.
Engineering, Administrative and Procedural	The flare tip ignition system is designed and operated to minimise the impact of flame-out events through automatic ignition upon detection of a flare flame-out event and includes: • Thermocouples for monitoring with redundancy monitoring via the thermal camera	Yes	The flare system is a safety and loss prevention system and is required for the safe disposal of hydrocarbons in the event of process upsets or emergency situations. Flaring of hydrocarbon reduces the GHG emissions in comparison to these gases being vented. Flare tip integrity and ignition system functionality ensures safe disposal of hydrocarbons by combustions instead of cold venting, flaring of hydrocarbons reduces GHG emissions compared to venting.	9.11	Flare flame-outs are detected: • through thermocouple feedback to the DCS through an alarm (“PILOT OFF” <150°C) upon detection of a loss of pilot flame; or • by the thermal camera with a DCS alarm which is activated when a flare flame-out is detected	DCS records of detection of flame-outs events.
				9.12	Flare flame-outs are ignited: • within 5 minutes of detection, through activation of the automatic ignition sequence, which if remains in	DCS/PI records demonstrate the duration of flame-out events. Flame- out events recorded in Sphera.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
	• Auto-ignition capability with redundancy ignition via the FFG • The Operations Playbook details the action to be taken upon detection of a flare flame-out. • Maintenance of the system in accordance with CMMS defined in Section 10.5.8 and 10.5.9. .		There are four flare tips on Prelude; high pressure and low pressure dry and high pressure and low pressure wet flares. Both low pressure flares are fitted with three pilots, whilst the high pressure flares are fitted with four pilots. Each pilot has two thermocouples, one online and one in spare. The thermocouples are the primary means of monitoring the pilots, with redundancy available through the use of the thermal camera which also has a DCS alarm which activates when a flare flame-out is detected. Each pilot is designed with two ignition mechanisms. The primary means of flare pilot ignition is via the cylinder head temperature gauge pilot ignition skids which rely on the thermocouple feedback to auto-ignite the pilots upon detection of loss of flame. When the pilot is above 150°C, the pilot flame is shown as "PILOT ON" on the local panel and control room operator console. When the pilot is below 150°C, the low temperature alarm (“PILOT OFF” < 150°C) is displayed and the automatic ignition sequence commences. During the automatic ignition sequence, if the system is not already in alarm, each pilot fires in turn at seven second intervals and stops after sixty seconds. If a pilot remains in alarm after one minute, ‘Re-ignition Failure’ alarms to alert the operator to repeat the ignition sequence via manually intervening on the control room operator console to re-initiate the ignition sequence. The secondary means of igniting the flare pilot is via the flame front generator which is operated locally in the field. The flame front generator panel is used to create a combustible gas / air mixture within the flame front line (one per pilot nozzle). Only one pilot can be lit at a time by the flame front generator. EPS’s 9.11 and 9.12 will be the relevant EPSs for flare monitoring and ignition following the replacement and reinstatement of the primary monitoring and ignitions system as required by EPS 9.14. Until the replacement, EPSs 9.15 and 9.16 will be applied. Maintaining the system in accordance with CMMS will help ensure the functionality of the ECEs is met. ECEs are maintained in accordance with CMMS, as outlined in Section 10.5.8 and 10.5.9 to ensure they are within reliability, availability, and accuracy requirements for the equipment. Performance of the flare system will be tracked through the GHGEMP, annual abatement workshop report, and goal setting process described in Section 10.6.10.6.8. Any flame-out events will be recorded in the DCS and reported in Sphera.		alarm after one minute triggers manual intervention by the operator to repeat the ignition sequence; or • within 30 mins of detection by following the Operations Playbook for the applicable ignition sequence using the FFG	
				9.13	The following components of the flare tip monitoring and ignition system are categorised as ECEs: • Pilot monitoring system • Flare pilot ignition system • FFG • Thermal Cameras and are prioritised, managed and confirmed to be functioning in accordance with the CMMS.	CMMS maintenance records.
			Flame-out Events Between 2021 and 2024, a total of 36 flame-out events, resulting in approximately ~1,400 tCO_2-e emissions from venting occurred. Each flame-out event was a non-compliance with EPS 8.01 and 9.06 of the previous EP revision. As a result of the repeat ENC’s a detailed causal investigation was conducted to identify the potential causes that were preventing the pilot system from operating as designed. It was confirmed that both the primary monitoring and ignition systems were not operating as per design and replacement	9.14	Replacement and reinstatement of the primary monitoring and ignition system will occur during the next planned flare outage, which is currently planned for 2030.	Confirmation of reinstatement of the monitoring and ignition systems.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			of the systems was required. A Long Term Remedial Action Plan was prepared and submitted to NOPSEMA in February 2025 and included the actions that had been completed to address the flare flame-out issues, including mitigation/contingency actions to prevent/minimise cold venting from the flare, and the details regarding the proposed long-term solution for replacement and reinstatement of the primary monitoring and ignition systems. Following the implementation of various corrective actions, including specific focus on responding to flame-out events through use of the FFG, there has been a significant reduction in the time taken to re-ignite the flare and therefore minimising the resultant GHG emissions. In 2025 between Jan and Sept a total of 14 flame-out events were recorded, however only ~110 tCO2 e were emitted. **Replacement and Reinstatement of the Primary Monitoring and Ignitions Systems** The proposed long-term plan for reinstatement of the Prelude flare monitoring and ignition systems is based on the expectation that the flare will be taken out of service during the 2030 maintenance turnaround. Flare outages are planned based on risk-based inspection requirements which currently require the flare to be taken out of service approximately every eight years to monitor corrosion and other degradation mechanisms. The last flare outage was undertaken during the 2023 maintenance turnaround, with the findings analysed under API 570 requirements as committed in Prelude's Safety Case. The results have placed the next risk-based inspection interval at 2030. Additionally, the execution of the works in 2030 provides the opportunity to reduce the Turnaround emissions load by allowing for time to install an ignited vent on the maintenance vent. During a turnaround when the flare is out of service, boil-off gas is directed to the maintenance vent. The greenhouse gas impact associated with venting of boil-off gas during a maintenance Turnaround with the flare out of service is two orders of magnitude greater than the venting that occurs from the occasional flare flame-out events (i.e. undertaking an additional flare outage in 2026 compared to the planned outage in 2030 would increase Prelude's emissions two orders of magnitude). Execution of the work in 2026 is therefore not considered ALARP from an emissions perspective. The cost of a flare inspection is significant due to complexity of applying an isolation on the system to allow personnel to safely work on the flare structure. Time for the flare isolation alone was 20 days in duration for the 2023 Turnaround. Flare de-isolation also adds additional time at the back end of the turnaround and within the shutdown and start-up sequencing. A conservative estimate of the additional duration of a Turnaround event by inclusion of a flare outage is 30 days. Based on current LNG pricing the cost of a flare outage in a turnaround is approximately AUD$300 million with the addition of actual scope performed added on top of this (i.e. undertaking an additional flare outage in 2026 compared to the planned outage in 2030 would result in a loss to the Prelude joint venture of approximately AUD$300 million).			

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			The RBI program is critical to optimise inspection intervals and allow priority to scope to be executed at the right time. To bring the flare system down in both 2026 and 2030 is grossly disproportionate to the value gained, particularly when reliability of the current system cannot meet the service length expectation of even four years, and is therefore not considered to be ALARP.			
			Thermal Camera Thermal camera monitoring is in place to provide a secondary means of flare monitoring which provides a clear a visual of the flare deck. It has real time analytical capabilities to assess the video feed and determine if a flare flame out has occurred. This is embedded in the DCS system to initiate an alarm when upon instance of a potential flame out. Visual monitoring of the flare with the thermal camera image is also visible to the operator via the CCTV screens at the Upstream Panel and also at the Utilities Panel.	9.15	Until replacement and reinstatement of the primary pilot monitoring system, the thermal camera will be used for monitoring the flare including smart monitoring of the image with a DCS alarm when a flare flame-out is detected. Visual monitoring of the flare via the optical CCTV camera is also available to visually detect flare flame-out events.	DCS records demonstrate detection of flare-flame-out.
			Flame Front Generator (FFG) The FFG will be used for re-ignition while the primary ignition system is in-operable. A testing campaign was conducted in the June/July period of 2024 to confirm the operational availability of the FFG for each of the pilots for each of the flares (14 pilots total). An entry in the Operations Playbook has been made to inform offshore operations to use the FFG in a specific sequence to give the best reliability of re-ignition. Due to the simplicity of the FFG design and its inherent reliability testing of the equipment is not frequently required and an annual testing regime is deemed adequate. Should successive testing campaigns show a significant change or drop in performance of the FFG system testing campaigns will become more frequent if necessary.	9.16	If a flame-out is detected and confirmed via the DCS alarm (or visually), the Operations Playbook is followed for the applicable ignition sequence using the FFG, with the flare reignited within 30 mins of identification of the flame-out.	DCS/PI records demonstrate the duration of flame-out events. Flame-out events recorded in Sphera.

Engineering, Administrative and Procedural	Use of N_2 vs fuel gas as flare purge.	Yes	By design Prelude needs to have a constant supply of gas to keep flares lit and a constant purge going through the flare headers to avoid air ingress and maintain safe operations. To reduce the GHG impact, the flares should be purged with N_2 as a primary source or with fuel gas as the backup source.
			If all flare headers are on fuel gas purge, ~1,000 tCO_2e is emitted per month. This equates to approximately 0.5% of the total monthly GHG emissions from the facility.
			The LP Wet flare, which currently has no working thermocouples, is purged with fuel gas to minimise the risk of a flame-out event, which results in the emission of ~240 tCO_2-e per month. Once the thermocouples are reinstated (refer to EPS 9.12) the purge will be switched back to N_2.
			The current base case is for all flare headers (except the LP Wet) is to remain on N_2 purge, except under the following conditions:
			• Unavailability of N_2
			• During functional testing of the FFG as required in accordance with the CMMS
			• If there is a risk that the pilot may not remain alight such as:
				9.17	All flares except LP Wet, remain on N_2 purge except under the following conditions:
					• Unavailability of N_2
					• During functional testing of the FFG as required in accordance with the CMMS
					• If there is a risk that the flare may not remain alight such as:
					  ○ during extreme weather events
					  ○ during tank inerting
						DCS/PI records demonstrate source of purge gas.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			○ during extreme weather events ○ during tank inerting It is noted however that the pilot and purge gas from the flare is excluded from the planned flaring "holding baseline" as described in EPS 10.10			
Engineering, Administrative and Procedural	Continuous operational flaring during steady state production is tracked against a "holding baseline", and a "loading baseline" which applies when offtakes are being conducted. Sources of planned flaring that contribute to the holding baseline include: • Condensate tanks • Produced water flash gas vessel	Yes	The flare system is a safety and loss prevention system and is required for the safe disposal of hydrocarbons in the event of process upsets or emergency situations. Flaring of hydrocarbon reduces the GHG emissions in comparison to these gases being vented. The previous in-force EP referenced 'no planned flaring during routine operations' (EPS 9.1), with a commitment to develop a baseline of 'no routine flaring' once Prelude reached steady state operations, but no later than the end of 2022. In December 2022 a baseline for "no routine flaring" for the two main operating modes of the facility were developed: • **Holding mode** for when the facility is producing at steady rates; the baseline for holding mode was 50tHC per day • **Loading mode** for when the facility is producing but also transferring product into an LNG carrier, the baseline for loading mode was 200tHC per day The baselines were calculated by assessing operational data from April to September 2022 which provided 88 data points for stream days at steady rates of production with no equipment trips. It is noted that the flaring baseline does not include pilot gas or any intermittent planned or unplanned flaring sources (as discussed in Section 9.12.4.3). During 2023 nine exceedances of the baseline were recorded. However significant improvement was seen particularly with regard to the loading baseline, with the development of a work procedure to enable Prelude to optimise all available levers to reduce fuel gas supply and to send LNG as cold as possible to reduce BOG production in the cargo tanks. In 2024 the baselines were re-assessed based on operational performance data between January and July 2024 with the holding baseline held at 50 tHC per day and the loading baseline reduced to 150 tHc per day. No exceedances of these baselines were recorded in 2024 or 2025. Following the work conducted to establish the flaring baselines it was identified that during steady state production there remains only two continuous sources of flaring: • **Condensate tanks:** During normal operations, the condensate tank is not designed to route back to fuel gas, therefore any vapour generated will be sent to Prelude's flare system. Vapour from condensate tanks is flared continuously to the low-pressure wet flare (FWL). • **Produced water flash gas vessel V-64031:** During normal operations, absorbed gas from produced water flash gas vessel is flashed to the low-pressure wet flare (FWL) continuously. In October 2025 a revised holding baseline of 20 tHc per day for planned flaring from the condensate tanks and the produced water	10.11	Continuous operational flaring from the: • Condensate tanks; and • Produced water flash gas vessel tank will not exceed the holding baseline of 20 tonnes of hydrocarbon per day.	Evidence of tracking compliance with the holding and loading baselines is included in DSR records and Fuel and Flare Forum meeting minutes. Flaring records and Sphera reports on baseline exceedances. Note for file (or similar) documenting the annual review and revised loading baseline.
				10.12	Flaring will not exceed the in place loading baseline, which is re-assessed annually to demonstrate that flaring during loading operations is ALARP.	

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			flash gas vessel, was developed based on the maximum volume flared from these sources over the previous 6 months. This reduction is reflective of the improved plant reliability and successful implementation of optimisation measures. Based on an average of 20 tHC per day, planned flaring will contribute ~<1.5% of total GHG emissions from Prelude. Average flaring performance during offtakes has improved significantly over the last 2-3 years, with near zero offtake flaring possible when all operational levers are available and can be effectively set at optimum on both the facility and carrier sides. Flaring during offtakes in 2025 contributed to only ~1% of the total GHG emission from flaring (see Figure 9-13). However, several factors that can still contribute to additional flaring during offtakes include: • Operation of the Wet Fuel Gas Heater which consumes the FG buffer from the sink created to accommodate additional supply from carrier and offtake activity. • Split parcels to allow tank consolidation in both Prelude and carrier side. These are occasionally required due to operational or weather constraints. • Cargo cooldown activity. The loading baseline will be re-assessed annually to demonstrate that flaring is ALARP and that where possible continuous improvement is demonstrated. However, factors considered when re-assessing the baseline will include both performance over the previous year as well as the production forecast for the following year, which will directly impact the loading baseline and may result in an increase in the baseline, particularly following the start-up of Crux. For the operating year of 2026 the loading baseline has been set at 25tHc per day. Flaring performance is monitored daily as part of the Daily Surveillance Review (DSR) which includes daily flare target tracking and alerts via the UTL shift reports, identification of any flare deviations and escalation and action planning. Compliance with the holding and loading baselines is tracked on a weekly basis and any causes of elevated flaring, including options for mitigation or repair are discussed in the DSR. Any exceedance of the baseline is recorded in Sphera and investigated to capture any learnings. Data provided in Section 9.12.3, clearly demonstrates the improvement that has been seen in flaring performance which is largely contributed by increased reliability, but also to the increased focus on reducing flaring to ALARP through the implementation of the holding and loading baselines.			
Administrative and Procedural	Planned intermittent flaring and unplanned flaring are managed to ALARP through: • Implementation of the Greenhouse Gas and Energy	Yes	Flaring performance on Prelude has improved significantly since commencement of operations in 2018 (refer to Table 9-89), with peak flaring GHG emission of 1.68 MtCO_2-e in FY18/19, compared to only 0.114 Mt CO_2-e in FY24/25. Forecasts predict a yearly	10.13	Planned equipment maintenance events that may result in increased flaring are discussed and tracked in the DSR and DPR meetings with consideration given to GHG impacts in the planning process.	Evidence of consideration of GHG impacts and tracking of amount flared included in DSR and DPR records.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
	Management System (GHGEMS) as detailed in Section 10.7, including implementation of the Fuel and Flare Policy. • Daily Surveillance Review (DSR) and Daily Production Review (DPR) meetings. • The Operations Playbook provides guidance to minimise GHG emissions during planned plant shutdowns and start-ups.		average of 0.079 $MtCO_2$-e (or approximately 3.3% of total emissions over the life of this EP) (refer to Table 9-91). The improved reliability of the facility together with the implementation of the Automated Process Control (APC) to automatically adjust Main Cryogenic Heat Exchanger (MCHE) parameters to minimise FG supply when required, and LNG tank pressures to ensure oversupply of the FG network is minimised, has contributed significantly to the reduction of flaring volumes. Flaring sources from Prelude can be broken down into three broad categories: • Continuous Operational Flaring • Planned Intermittent Flaring • Unplanned Flaring Continuous operational flaring is managed to ALARP through the implementation of the holding and loading baselines (refer to EPSs 10.11 and 10.12). Planned intermittent flaring is largely as a result of either planned shutdowns and start-ups, planned maintenance or planned well interventions. Such events are scheduled as part of the Integrated Activity Planning (IAP) process with GHG impacts considered in the planning process with a specific focus on consolidation of work scopes to minimise depressurization/gas purging activities. In accordance with the Fuel and Flare Policy any event that is likely to result in a >5 ktCO2-e increase in incremental GHG emissions or is likely to result in flaring for a duration of longer than 5 days requires an ALARP assessment. The emission amount and timeframe for the ALARP assessment is based on a review of historical compressor failure flaring data and includes consideration of aspects which impact repair timeframes such as part procurement, mobilisation of specialist personnel, hours/days required for depressurisations and process isolations, and weather. It should be noted however, that flaring minimisation is discussed during daily coordination meetings such as, but not limited to the DSR and DPR meetings. During 2025, planned maintenance activities accounted for ~3% of the total GHG emissions that occurred from flaring (see Figure 9-13). Unplanned flaring events can occur for numerous reasons when it is required to protect the integrity of the facility and to prevent harm to personnel, the environment and equipment. Such events include, but are not limited to: • Trips and shutdowns/start-ups, ranging from full facility trips, to warm end or cold end trips, or equipment/compressor trips • Management of tank tops requiring ramp down of production • Fuel gas imbalances • Equipment impairments, including passing valves The Prelude Operations Playbook includes direction to panel operators that depending on which type of trip the facility has experienced, what fuel mode to run the plant on in order to minimize	10.14	Any intermittent flaring events (planned and unplanned), excluding scenarios covered in the Operations Playbook, that are expected to result in a >5ktCO2-e increase in incremental GHG emissions, or with a duration longer than 5 days, will have an ALARP assessment completed.	Note for file (or similar) documenting ALARP Assessment.
				10.10	The Operations Playbook directs panel operators on what fuel mode to run the plant on in order to minimise total GHG emissions, depending on which type of trip the facility has experienced.	Records of implementation of the Operations Playbook

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			total GHG emissions. For those events not captured in the Operations Playbook these will be managed in accordance with the Prelude Fuel and Flare Policy, with an ALARP assessments required for any event that is likely to result in a >5 ktCO2e increase in incremental GHG emissions or result in flaring for a duration of longer than 5 days. Where equipment impairments, including passing valves, are contributing to flaring, every effort is made where feasible to conduct the required maintenance activities whilst the facility is online. The CMMS process considers the GHG impacts due to the impaired equipment and adjusts priorities as required. It is important to note, however, that some impairments may require a facility shutdown to allow the required maintenance to be undertaken. Reliability of the facility significantly impacts the amount of unplanned flaring that occurs on Prelude and therefore the amount flared will vary each year depending on the number and type of unplanned flaring events, and the associated duration of such flaring. During 2025, ~80% of the GHG emissions associated with flaring were from unplanned events (see Figure 9-13), with the majority of these emissions occurring in January and February as a result of two full facility trips.			
Administrative and Procedural	Shell Group supports customers to help reduce their emissions through a system which includes: • a target to reduce the net carbon intensity of the energy products we sell by 15-20% by 2030, and 100% by 2050, compared to a base year of 2016 (Scope 3 emissions target); • investing in lower carbon platforms. Shell Group currently has $20 billion of capital employed across its lower carbon platforms (including low carbon fuels, hydrogen, Carbon Capture & Storage and gas fired and renewable power) and expects to have up to 10% of capital employed in lower carbon platforms by 2030.	Yes	To help our customers reduce their emissions Shell Group have set targets to reduce the net carbon intensity (NCI) of the energy products it sells by 15-20% by 2030, and 100% by 2050. The intended use of the NCI metric is to track progress in reducing the overall carbon intensity of the energy products sold by Shell globally. Net carbon intensity measures emissions associated with each unit of energy we sell, compared with a 2016 baseline. Shell Group reports on its business activities (including updates concerning gas-related projects) and progress against its business targets, including climate-related targets, on an annual basis in its Annual Report. It also publishes an annual LNG Outlook. Shell Group publishes its Energy Transition Strategy (ETS) every three years—most recently ETS24, with updates currently expected in 2027 and 2030. Scope 3 emissions, including those associated with the activity, which are equivalent to less than 0.03% of global GHG emission inventories, are outside the operational control of the Prelude joint venture partners (see Section 9.12.5) and of the Shell Group. Shell addresses Scope 3 emissions at a Shell Group level, in view of the global nature of greenhouse gas emissions, and for other structural reasons – i.e. the absence of control over those emissions, which are driven by energy demand, and the existence of portfolio-wide levers to reduce the intensity of emissions at a Shell Group level. Shell is helping its customers to decarbonise and reduce their emissions (Scope 3 emissions), achieved through the application of Shell's Group-wide strategy to deliver more value with less emissions, including targets and processes designed to identify and implement reasonably practicable measures related to the overall emissions profile across its entire portfolio. In the context of Scope 3	10.15	Shell Group to progress its Scope 3 emissions target and investment, aligned with stated timeframes. Any significant change at the Shell Group level to these targets and investments will be reflected in the Annual Report and, when next updated, the ETS, with any additional measures (or changes to existing measures) determined and implemented through changes to the Group's portfolio management and capital allocation. At the asset level, Shell Australia will incorporate the outcomes of the triennial ETS review, where appropriate and practical, into the subsequent annual update and assurance of the GHGEMP.	Shell Group, disclosures and publications including the Annual Report and Accounts 2025 | Shell Global and Energy Transition Strategy review, update and report on these targets and investments, at least triennially, to demonstrate the EPS has been met. Records including the Annual Report and Accounts 2025 | Shell Global and Energy Transition Strategy demonstrate that any additional measures (or changes to existing measures) as a result of ongoing review and adjustment have been considered and where required actioned. The GHGEMP includes any appropriate and practical asset level measures.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			emissions, this relevantly includes the Shell Group target to reduce the NCI of the energy products it sells. Shell's Group-level targets are subject to ongoing review and adjustment to ensure alignment with evolving regulatory and market contexts, including updates driven by regular reviews of the Shell Group's ETS, LNG Outlook and other relevant policy or industry developments. Shell monitors and assesses its progress against Group-level targets on a continuous basis. Shell Group disclosures and publications including the Annual Report and ETS review, update and report on these targets, and investments, at least triennially. Any significant change at the Shell Group level to these targets and investments would necessarily be reflected in the Annual Report and, when next updated, the ETS, with any additional measures (or changes to existing measures) determined and implemented through changes to the Group's portfolio management and capital allocation. Records demonstrating that such measures have been considered and, where required, actioned through those processes will be available in the Shell disclosures and publications above. Following the Shell Group review of the ETS, at the asset level, Shell Australia will incorporate the outcomes of the review, where appropriate and practical, into the subsequent annual update and assurance of the GHGEMP and its integration into the Operating Plan (see Section 10.7.4). This integration supports continuous improvement and adaptive management, ensuring that emissions performance under operational control of the Prelude joint venture partners remains consistent with Shell Group's broader decarbonisation objectives and targets, and that any appropriate and practical asset-level measures are identified, actioned and documented.			
Administrative and Procedural	Shell Group will continue to implement systems to work with industry, governments and others to reduce methane emissions across the full natural gas value chain, with a target to: • maintain methane emissions intensity below 0.2% and achieve near- zero methane emissions intensity by 2030	Yes	Shell Group supports the reduction of methane emissions across the full natural gas value chain. Shell is signed up to the Oil & Gas Decarbonization Charter (OGDC), in which companies have pledged to achieve near-zero methane emissions intensity by 2030. In April 2024, Shell became the first official partner to the World Bank Global Flaring and Methane Reduction Fund Partnership. Shell are a founding signatory of the Oil and Gas Methane Partnership (OGMP) 2.0 reporting framework. Shell achieved the OGMP 2.0 Gold Standard in methane emissions reporting in 2023 and 2024.	10.16	Shell Group to continue to: • progress its methane emissions intensity targets aligned with stated timeframes. • support voluntary initiatives such as the UN-led Oil and Gas Methane Partnership (OGMP) 2.0 reporting framework, World Bank's Global Flaring and Methane Reduction (GFMR) fund and Oil and Gas Decarbonization Charter.	Shell Group disclosures and publications including the Annual Report and Accounts 2025 | Shell Global and Energy Transition Strategy review, update and report on these targets and initiatives, to demonstrate the EPS has been met.
Administrative and Procedural	Contracting strategy and evaluation for deployment of support vessels includes consideration of vessel emissions parameters and low carbon and alternative fuels.	Yes	Fuel cost over contracts are considered in the evaluation of contractor responses, allowing for competitive consideration of low carbon alternatives. Minimises costs and emissions through eco-efficiency approach recognising cost of fuel and carbon emissions over the contract term.	10.17	Support vessel tenders will evaluate: • fuel cost over the term of contracts, • vessel emission parameters, and • low carbon fuel alternatives.	Contract request for tenders and/or tender evaluation records.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			Control effectively allocates a cost to emissions to recognise that higher emitting fuel sources with other lower operating costs do not represent overall best value.			
Administrative and Procedural	Marine support vessels (as appropriate to vessel class) will comply with MARPOL Annex VI (Prevention of Air Pollution from Ships), the *Navigation Act 2012* (Cth), the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and subsequent Marine Orders.	Yes	Reduces GHG emissions through operating and maintaining vessels in accordance with industry standards and regulatory requirements.	9.21	Vessels are required to have this valid documentation, as required by vessel class, size and type: • EIAPP certificate • IAPP certificate IEE certificate • SEEMP	Marine Assurance Record confirming valid SEEMP and IAPP, EIAPP, IEE certificates are in place for vessels (where required by vessel class, size and type).
				9.22	Waste from incineration managed in accordance with MARPOL Annex VI.	A copy of the completed garbage record book or official recording system that captures incinerated waste records. Records of an IMO type approval certificate for each incinerator in use, demonstrating the incinerator is designed for operation within the limits of Regulation 16 of MARPOL Annex VI.
				9.23	ODS managed in accordance with MARPOL Annex VI to reduce the risk of an accidental release of ODS to air, as required by vessel class, size and type.	A copy of the current and maintained ODS Record Book or recording system.
Administrative and Procedural	Vessel specific biofouling management and/or risk assessment.	Yes	Implementing biofouling controls reduces the potential for project vessel water drag. Hence, project vessel hull integrity improves vessel fuel efficiency.	6.3	Vessels (as appropriate for size, type and class) entering Australian territorial seas [12 nm limit] from international locations, prior to entering the Activity Area, will apply the Australian Biofouling Management Requirements (DAFF 2023), including: • an effective biofouling management plan and record book; or • vessel cleaned of all biofouling within 30 days prior to arriving in Australian waters; or • implementation of an alternative biofouling management method.	A copy of the Biosecurity Status Document (issued via Maritime Arrivals Reporting System) showing an approved biofouling status.
				6.4	Vessels (as appropriate for size, type and class) entering the Activity Area directly from international locations will implement the following requirements derived from the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2009): • conduct a biofouling risk assessment using an industry recognised IMS inspector; and • undertake IMS risk reduction measures as guided by an industry recognised IMS inspector if a vessel is not considered low risk; and • only vessels classified as low risk will be permitted entry into the Activity Area.	IMS Inspection Report that classifies the vessel as low risk, and if required, evidence of the mitigation measures implemented to reduce the risk to low.
				6.5	Locally sourced vessels (as appropriate for size, type and class) entering the Activity Area from Australian domestic locations, will implement the following requirements derived from the Australian National Biofouling Management Guidance for the Petroleum	IMS risk assessment and supporting records which demonstrate implementation actions have been carried out as required, that classifies the vessel as low risk.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
					Production and Exploration Industry (Marine Pest Sectoral Committee 2009): • conduct a biofouling risk assessment using an industry recognised IMS inspector or using a Shell endorsed IMS risk assessment tool; and • undertake IMS risk reduction measures if a vessel is not considered low risk (either guided by an IMS inspector or using risk assessment tool outcomes); and • only vessels classified as low risk will be permitted entry into the Activity Area.	

ALARP Demonstration Statement

Based on the impact assessment outcomes and control measures adopted, Shell considers implementing the control measures appropriate to manage GHG emissions to ALARP. These measures include the use of efficient power generation, minimisation of diesel combustion, and operational controls to reduce flaring and venting. GHG management planning is aligned with regulatory frameworks such as the NGER Act and the Safeguard Mechanism.

9.12.11 Acceptability of Impacts

Given the controls proposed, and the fact that the GHG emissions associated with Prelude are expected to have a *de minimis* impact on global and Australian carbon budgets, there is no impact to the overall consequence level reasonably expected and therefore it is considered acceptable. Nonetheless Shell recognises that direct emissions must be reduced to ALARP by implementing the control measures outlined in Table 9-101 and achievement of the associated EPOs listed in Section 9.12.12 to be acceptable. The proposed controls are industry best practice and consistent with:

- principles of Ecologically Sustainable Development (ESD)
- relevant legislative and industry requirements
- relevant requirements in relation to Matters of National Environmental Significance (MNES)
- internal and external context
- the defined acceptable level of GHG emissions as set out in Section 8.

The potential impacts and risks are considered acceptable if the proposed controls are implemented.

Table 9-102: Acceptability of Impacts – Greenhouse Gas Emissions

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Subcategory**			
Protected Areas	Marine Conservation Reserves	No impacts to the values of marine parks.	Yes	The GHG emissions from the activity are expected to have a *de minimis* impact on global and Australian carbon budgets and therefore Shell has assessed that there is no impact to the overall consequence level reasonably expected. It will nevertheless manage its GHG emissions and any potential impacts to ALARP. While there are observed and predicted physical effects of climate change to the Australian environment, such impacts cannot reasonably be attributed to a single activity's GHG emissions Although it is possible to quantify the GHG emissions associated with the Activity (as described in Section 9.12.8.1) it is well-established that GHG emissions rapidly diffuse and commingle in the atmosphere. Further, the GHG emissions arising from the Activity will be *de minimis* in the context of total global and Australian emissions. As such, it is not possible to attribute the physical effects of climate change on Australian environmental values and sensitivities to a particular Activity given such effects arise as a result of
	Wetlands of International and National Importance	No impacts to the ecological values of wetlands of international and national importance.	Yes	
	Commonwealth and national heritage places	No impacts to Commonwealth or national heritage places values.	Yes	
Physical and Natural Features, Values and Sensitivities	Australian environment	No significant impacts to the Australian environment.	Yes	
	BIA's	No significant impacts to functional values of BIAs. Impacts do not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat that results in an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area.	Yes	
	Critical Habitat	No significant impacts to functional values of critical habitat. Impacts do not modify, destroy, fragment, isolate	Yes	

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	Subcategory			
		or disturb an important or substantial area of habitat that results in an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area.		cumulative global GHG emissions. Shell recognises that direct emissions must be reduced to ALARP by implementing the control measures outlined in Table 9-101 and achievement of the associated EPO listed in Section 9.12.12 to be acceptable. These emissions will be in accordance with relevant requirements, such as Australian GHG emissions reporting, where required by the NGER Act.
	Shoals and Banks	No direct impacts to named banks and shoals. No loss of coral communities at named banks or shoals as a result of indirect/offsite impacts No known or potential pest species become established in the Commonwealth marine area.	Yes	
	Offshore Reefs and Islands	No impacts to offshore reefs and islands. No known or potential pest species become established in the Commonwealth marine area.	Yes	
	Coastal Reefs and Islands	No impacts to coastal reefs and islands.	Yes	
	Key Ecological Features (KEFs)	No significant impact to environmental values of KEFs	Yes	
	Threatened, Migratory, Marine and Cetacean Species	No mortality or injury of cetaceans. Management of aspects of the activity must align with conservation advice, recovery plans and threat abatement plans (Table 8-1). No significant impacts to EPBC Act listed threatened, migratory, marine or cetacean species.	Yes	

Principles of ESD

The Activity aligns with the principles of ESD in several key ways to minimise the environmental impacts and promote sustainability:

- Principle of integration: This principle emphasises the need to balance long-term and short-term economic, environmental, social, and equitable considerations in decision-making. Prelude has integrated measures to reduce GHG emissions, while factoring in safety considerations and balancing other project trade-offs such as cost and availability of alternatives.
- Precautionary principle: This principle requires that where there are 'threats of serious or irreversible environmental damage, lack of full scientific certainty should not postpone measures to prevent environmental degradation.' Although it is possible to quantify the GHG emissions associated with the Activity it is well-established that GHG emissions rapidly diffuse and commingle in the atmosphere. Further, the GHG emissions arising from such Activity will be *de minimis* in the context of total global and Australian emissions. As such, it is not possible to attribute the physical effects of climate change on Australian environmental values and sensitivities to a particular Activity/project given such effects arise as a result of cumulative global GHG emissions. Nevertheless, the impact assessment presented describes, for contextual purposes only, the potential physical effects of climate change on sensitive receptors, including MNES within Australian jurisdictions.
- Principle of inter-generational equity: This principle emphasises that the health, diversity, and productivity of the environment are maintained or enhanced for the benefit of future generations. Prelude Activities meet this principle by ensuring GHG emissions comply with all relevant laws, thus protecting future generations.
- Conservation of biological diversity and ecological integrity: This principle emphasises the importance of conserving the biological diversity and ecological integrity in decision-making. The assessment followed Shell's requirements to identify and minimise negative environmental, social and health impacts while optimising positive impacts. This framework continues through the execution of the Activities in this EP (see Sections 6, 8 and 9).
- Improved valuation, pricing, and incentive mechanisms: This principle promotes the use of valuation, pricing, and incentive mechanisms to support sustainable practices. The Prelude facility considers global policies and actions related to GHG emissions and complies with Australian legislation, including the Safeguard Mechanism. ALARP principles are used to support risk assessment and decision-making, ensuring environmental risks are minimised and managed effectively.

Relevant Legislative and Industry Requirements

The Activity is consistent with the strategy and frameworks put in place by the Australian Government to support Australia's transition to net zero.

DISR's 'Future Gas Strategy' (DISR 2024a) (the DISR Strategy) provides a comprehensive framework for how gas will support Australia's transition to net zero. It balances the need for reliable energy supply with the goal of reducing GHG emissions, ensuring public and regulatory involvement, and aligning with international commitments. The NGER Act and Safeguard Mechanism play crucial roles in monitoring and managing GHG emissions, supporting Australia's broader climate goals.

The DISR Strategy provides a framework which recognises that Australia is, and will remain, a reliable trading partner for energy, including LNG and low emission gases. The DISR Strategy emphasises Australia's ambition to become a renewable energy superpower by developing new, low GHG emissions energy exports to support the energy security and decarbonisation efforts of its trade partners. The DISR Strategy provides an in–depth analysis of gas supply, consumption, and GHG emissions. The public consultation which shaped the DISR Strategy revealed the barriers and opportunities in gas supply and consumption for Australian households, businesses, and international trade partners. The DISR Strategy acknowledges that the role of gas will evolve as Australia strives to reach net zero by 2050. Even in net zero scenarios, Australia and the world will need gas through to 2050 and beyond. Australia's commitment under the Paris Agreement includes reducing net GHG emissions to 43% below 2005 levels by 2030 and achieving net zero emissions by 2050 (DCCEEW 2023c). The *Climate Change Act 2022* (Cth) legislates these targets, with a multi-year emissions budget set at 4,381 $MtCO_2$-e from 2021–2030. Additionally, the DISR strategy commits the government to

work with regulators and industry to reduce, and where possible eliminate venting and flaring of gas unless required for safety purposes, with the development of a Policy Statement which was published in December 2025 (DISR, 2025). The policy statement highlights the role of the titleholder, who under the requirements of the OPGGS(E) Regulations, is required to consider and adopt control measures to prevent, reduce, monitor, and offset emissions from venting and flaring activities to reduce impacts to ALARP and an acceptable level, and the role of NOPSEMA to assess venting and flaring activities to be undertaken by the titleholder as part of the Environment Plan decision making process.

The NGER Act provides a national framework for reporting GHG emissions, energy production and energy consumption. Its objectives are to:

- inform government policy
- inform the Australian public
- help meet Australia's international reporting obligations
- assist Commonwealth, state, and territory governments to implement GHG reduction projects
- avoid duplicating similar reporting requirements in the states and territories.

Under the NGER Act, corporations that meet certain thresholds are required to report on GHG emissions, energy production and energy consumption. This reporting captures data about energy flows and energy transformations occurring throughout the economy. The NGER Act aligns with the GHG Protocol, a globally accepted set of standards for accounting for GHG emissions.

The Safeguard Mechanism under the NGER Act ensures Australia's largest emissions intensive industries measure, report and reduce their Scope 1 GHG emissions. It applies a decline rate to facilities' baselines so that they are reduced predictably and gradually over time on a trajectory consistent with achieving Australia's emission reduction targets of 43% below 2005 levels by 2030 and net zero by 2050.

Key elements of the mechanism include (DCCEEW 2023c):

- Facilities with GHG emissions exceeding 100,000 tCO_2-e (0.1 $MtCO_2$-e) per year must keep GHG emissions at or below set baselines
- If a facility exceeds its baseline, it must manage excess GHG emissions, such as by purchasing and surrendering Australian Carbon Credit Units
- A requirement to offset 100% reservoir CO_2 from new reservoirs feeding existing LNG facilities
- Facilities must meet reporting and record-keeping requirements, including audits
- Penalties for non-compliance.

The Safeguard Mechanism is relevant to GHG emissions at the Prelude FLNG facility (which is a Designated Large Facility under the NGER framework), and Shell has complied with and will continue to comply with the contemporary requirements as defined under the NGER Act and associated Safeguard Mechanism (including any future amendments or changes in law).

With regards to the processing of Crux energy on the Prelude FLNG, Shell as the Responsible Emitter of the Prelude FLNG facility, will be required to surrender prescribed carbon units equal to 100% of reservoir CO_2 separated from Crux feed gas at the facility, being an estimated 9.78 $MtCO_2$-e over the life of the reservoir. The Crux reservoir CO_2 is the responsibility of the facility from which it is emitted, in this case, the Prelude FLNG for the Crux reservoir.

Matters of National Environmental Significance

The GHG emissions from the activity are expected to have a *de minimis* impact on Australian (~0.52%) and global (~0.006%) carbon budgets (Table 9-97) and therefore Shell has assessed that there is no impact to the overall consequence level reasonably expected which is considered to be inherently acceptable.

Marine Parks

The Australian Marine Parks – North-west Marine Parks Network Management Plan 2018 (DNP 2018a) considers the effects of climate change and the potential impact on marine park values such as habitats, KEFs and marine fauna species. Implementing the EPO listed in Section 9.12.12 and the control measures outlined in Table 9-101 will manage the GHG emissions from the Activity. Shell has assessed no impact to the overall consequence level reasonably expected which is therefore considered to be inherently acceptable.

Threatened and Migratory Species

Table 9-103 lists the relevant EPBC publications that recognise climate change as a potential threat and summarises the demonstration of alignment. Shell has assessed no impact to the overall consequence level reasonably expected which is therefore considered to be inherently acceptable.

Commonwealth Marine Environment

The associated potential incremental impacts of the Activity on the Commonwealth marine environment were assessed against the significant impact criteria for MNES, and Shell considers they are not significant.

Table 9-103: Summary of Alignment with Relevant Requirements for MNES

MNES	MNES Acceptability Considerations (Significant Impact Guidelines, EPBC Management Publications)	Demonstration of Alignment
Threatened and Migratory Species – Marine Mammals	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1).	The GHG emissions from the activity are expected to have a *de minimis* impact on global and Australian carbon budgets and therefore Shell has assessed that there is no impact to the overall consequence level reasonably expected. While there are observed and predicted physical effects of climate change to the Australian environment, such impacts cannot reasonably be attributed to a single activity's GHG emissions Although it is possible to quantify the GHG emissions associated with the Activity (as described in Section 9.12.8.1) it is well-established that GHG emissions rapidly diffuse and commingle in the atmosphere. Further, the GHG emissions arising from the Activity will be *de minimis* in the context of total global and Australian emissions. As such, it is not possible to attribute the physical effects of climate change on Australian environmental values and
	Conservation management plan for the blue whale: A recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015–2025 (CoA 2015a).	
	Approved Conservation Advice *Balaenoptera borealis* (sei whale) (DoE 2015c).	
	Conservation Advice *Balaenoptera physalus* fin whale (TSSC 2015b).	
Threatened and Migratory Species – Marine Reptiles	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1).	
	Recovery plan for Marine Turtles in Australia 2017–2027 (CoA 2017b).	
	Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (TSSC 2008a).	
	Conservation Advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW 2024l).	
Threatened and Migratory Species – Birds	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1).	
	Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015a).	
	Wildlife Conservation Plan for Seabirds (CoA 2020).	
	Approved Conservation Advice for *Calidris canutus* (Red knot) (DCCEEW 2024n).	
	Approved Conservation Advice for *Limosa lapponica menzbieri* (Yakutian bar-tailed godwit) (DCCEEW 2024d).	
	Conservation Advice for Abbott's Booby – *Papasula abbotti* (TSSC 2020b).	

MNES	MNES Acceptability Considerations (Significant Impact Guidelines, EPBC Management Publications)	Demonstration of Alignment
	Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW 2024i).	sensitivities to a particular Activity given such effects arise as a result of cumulative global GHG emissions. Shell recognises that direct emissions must be reduced to ALARP by implementing the control measures outlined in Table 9-101 and achievement of the associated EPO listed in Section 9.12.12 to be acceptable.
	Conservation Advice *Calidris ferruginea* curlew sandpiper (DCCEEW 2023f).	
	Conservation Advice for *Charadrius leschenaultii* (greater sand plover) (DCCEEW 2023g).	
	Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW 2024e).	
	Conservation Advice for *Phaethon rubricauda westralis* (Indian Ocean red-tailed tropicbird) (DCCEEW 2023h).	
	Conservation Advice *Limosa lapponica baueri* (Alaskan bar-tailed godwit) (DCCEEW 2024c).	
	Conservation Advice *Numenius madagascariensis* eastern curlew (DCCEEW 2023e).	
	National Recovery Plan for the Australian Painted Snipe (*Rostratula australis*) (COA 2022).	
Threatened and Migratory Species – Sharks and Rays	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1).	
	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DOE 2014b).	
	Conservation Advice *Rhincodon typus* whale shark (DoE 2015e).	
	Recovery plan for the white shark (*Carcharodon carcharias*) (DSEWPaC 2013b).	
Commonwealth Marine Environment	Significant impact guidelines for Commonwealth marine environment (Table 8-1).	
Marine Conservation Reserves	Australian Marine Parks – North-west Marine Parks Network Management Plan 2018 (DNP 2018a).	

Internal and External Context

The Shell Group has an important role to play in the energy transition and aims to lead where it has competitive strengths, sees strong customer demand, and identifies clear regulatory support from governments. In this context, Prelude FLNG is an important part of delivering on the Shell Group's LNG Strategy and target to be a net-zero emissions energy business by 2050[84].

[84] Shell Group's Operating Plan, outlook and budgets are forecast for a ten-year period and are updated every year. They reflect the current economic environment and what we can reasonably expect to see over the next ten years. Accordingly, they reflect our Scope 1, Scope 2 and net carbon intensity targets over the next 10 years. However, Shell Group's Operating Plan cannot reflect our 2050 net-zero emissions target, as this target is currently outside our planning period. In the future, as society moves towards net-zero emissions, we expect Shell Group's Operating Plan to reflect this movement. If society is not net zero in 2050, as of today, there would be significant risk that Shell Group may not meet this target.

Australia is well-positioned to lead in the energy transition due to its resources, export markets, and skilled workforce. The Shell Group collaborates with governments and partners to support low-carbon energy production. Fossil fuels currently meet over 80% of global energy demand. As demand for energy continues to grow, driven by rising populations and increased prosperity, the world must transition from fossil fuels to low-carbon energy in a balanced and orderly way to achieve net-zero emissions, including by increasing electrification and renewable energy. The transition to net zero will not be linear, as different countries take different approaches and move at different paces.

The IEA forecasts that most of the world's future gas demand will come from the Asia-Pacific region, led by China, India and Southeast Asia.[85] This is largely driven by Asian economic growth, the need to decarbonise heavy industry and transport, and the emerging growth in the energy-intense technology sector, with LNG becoming a cost-effective fuel for shipping and road transport that can help bring down emissions.

This aligns with the basis for Shell's forecasted demand for gas and LNG into the future (see Figure 9-14). Shell sees LNG as facilitating, not replacing, the rapid growth of renewables in emerging markets. LNG growth is not in competition with renewables but supports the energy transition by providing the flexibility and stability the power grid needs with the rapid growth of renewable energy. As wind and solar power generation grows, power systems need flexible, dispatchable supply to help manage generation variability and seasonal demand.

LNG is a versatile energy source that can be used in power generation, industry, heating and transport. . Further, Shell's current and future LNG portfolio has, and is projected to have, one of the lowest carbon intensities in our industry.

Prelude and Crux energy is therefore anticipated to play a critical role in supporting its customers' commitments and plans to decarbonise through the energy transition, supporting both the growth of renewables and the provision of energy security.

The Shell Group is committed to reducing GHG emissions and has made good progress towards its targets and ambitions. By the end of 2023, Shell Group had achieved more than 60% of its target to halve emissions from its operations by 2030, compared with 2016. Shell Group was one of the first companies to set a target to achieve near-zero CH_4 by 2030. It continues to keep its CH_4 emissions intensity well below 0.2% and has reduced its total CH_4 emissions by 70% since 2016. Shell Group is also working with partners, industry, and universities to develop and implement technologies that reduce CH_4 emissions associated with the use of LNG.

Shell Group has also:

- Set a new ambition to measure its progress, to reduce customer emissions from the use of its oil products by 15-20% by 2030 compared with 2021 (Scope 3, Category 11)[86] .
- Set a target to reduce the net carbon intensity[87] of its products by 15-20% compared to 2016 by 2030 (6.3% reduction achieved by the end of 2023)[88].
- Set a target to eliminate routine flaring in upstream operations by 2025[89].

[85] World Energy Outlook 2025, pages 161-162, 214-217.

[86] Customer emissions from the use of our oil products (Scope 3, Category 11) were 517 MtCO2-e in 2023 and 569 MtCO2-e in 2021.

[87] Reference to Shell's "net carbon intensity" includes Shell's carbon emissions from the production of energy products, our suppliers' carbon emissions in supply energy for that production and our customers' carbon emissions associated with their use of energy products we sell. Shell only controls its own emissions. The use of the term Shell's "net carbon intensity" is for convenience only and not intended to suggest these emissions are those of Shell plc or its subsidiaries.

[88] The net carbon intensity of emissions associated with Prelude will be considered when measuring progress towards this target. The target will be delivered by the Shell Group on a net portfolio basis and reflects anticipated changes in the Shell Group's sales of oil and gas products, and changes in sales of low and zero-carbon products- such as biofuels, hydrogen and renewable electricity.

[89] Subject to the completion of the sale of Shell Petroleum Development Company of Nigeria Limited (SPDC). The target is consistent with the World Bank Zero Routine Flaring by 2030 initiative, which targets routine flaring of gas during oil production (upstream operations). While this target does not apply to gas projects including Prelude, Shell intends to minimise flaring to ALARP and acceptable levels.

- Investing $10–15 billion in low-carbon energy solutions between 2023–end 2025, in areas including electric vehicle charging, biofuels, renewable power, hydrogen and carbon capture and storage. In 2023 alone, Shell invested $5.6 billion in low-carbon energy solutions.

Shell Australia is one of Australia's largest producers of LNG and a significant contributor to the delivery of the Shell Group's LNG Strategy.

Acceptability Summary

Shell estimates the total GHG emissions for the lifecycle of the activity are ~205.79 $MtCO_2$-e (Table 9-95). The estimated annual Scope 1 emissions are equivalent to ~0.5% of national Australian emissions and total emissions are ~0.03% of global emissions (Table 9-97). Shell does not consider the Activity will result in any Scope 2 GHG emissions.

The GHG emissions from the activity are therefore expected to have a *de minimis* impact on global and Australian carbon budgets and Shell has assessed that there is no impact to the overall consequence level reasonably expected.

Although it is possible to quantify the GHG emissions associated with an Activity it is well-established that GHG emissions rapidly diffuse and commingle in the atmosphere. Further, the GHG emissions arising from the Activity will be *de minimis* in the context of total global and Australian emissions. As such, it is not possible to attribute the physical effects of climate change on Australian environmental values and sensitivities to a particular Activity given such effects arise as a result of cumulative global GHG emissions. Nevertheless, the impact assessment presented in Section 9.12.8 describes, for contextual purposes only, the potential physical effects of climate change on sensitive receptors, including MNES within Australian jurisdictions.

The assessment has been considered in the context of:

- principles of ESD
- relevant legislative and industry requirements
- MNES
- internal and external context
- defined acceptable level of GHG emissions as set out in Section 8.

9.12.12 Environmental Performance Outcome

EPO #	EPO	Measurement Criteria
10.1	Shell group supports customers to reduce their GHG emissions through; • target to reduce the net carbon intensity of the energy products we sell by 15-20% by 2030, and 100% by 2050; • investing in lower carbon platforms. Shell Group currently has $20 billion of capital employed across its lower carbon platforms (including low carbon fuels, hydrogen, Carbon Capture & Storage and gas fired and renewable power) and expects to have up to 10% of capital employed in lower carbon platforms by 2030.	Progress against targets and investments reported in the relevant Shell Group reporting, at least triennially (EPS 10.15.).
10.2	Undertake the activity in a manner that is compliant with: • the national requirements set out in the Safeguard Mechanism; and • maritime industry standards and regulatory requirements relevant to marine support vessels (as appropriate for size, type and class).	Public NGER reporting records (EPS 10.6). Marine Assurance Records

9.13 Minor Releases and Waste

9.13.1 Aspect Context

Incidental dropped solid objects or minor spills and releases of chemicals, hydraulic fluids, diesel, hydrocarbons, waste, and other substances (collectively referred to as minor releases) could accidentally enter the marine environment from the Prelude FLNG or vessels (including ROVs).

Improper storage and handling of solid objects may result in accidental losses to the marine environment. Solid objects may include:

- equipment (e.g. tools, installation aids, hard hats etc.)
- materials (e.g. infrastructure parts and supplies)
- waste:
- hazardous waste (e.g. oil-contaminated materials such as filters, rags, and sorbents, amine waste, spent chemical containers, paint solvents and containers, light tubes, batteries, sand and sludges generated during well clean-up operations and process vessel maintenance)
- non-hazardous domestic and industrial waste (e.g. bottles, aluminium cans, cardboard and scrap steel).

All wastes generated on board the facility (other than permitted waste discharge streams addressed elsewhere within this EP) are transported to shore for reuse, recycling, treatment or disposal by a licensed waste contractor. Note that any waste management and disposal within international jurisdictions is out of scope of this EP.

The waste management strategy for the activity is to optimise segregation of waste in the offshore location and minimise contamination of recovered waste destined for recycling or disposal. Waste segregation is established and maintained through the provision of labelled bins, skips or other appropriate receptacles used to comingle similar waste streams in accordance with their classification to realise efficiencies in storage, transport, treatment, recycling and/or disposal. All non-hazardous and hazardous solid wastes will be managed in accordance with the relevant waste management procedure and vessel-specific waste management plans and procedures. The disposal of non-hazardous and hazardous wastes will be tracked to confirm they are disposed of at an appropriately licensed waste facility on shore.

There are a number of dedicated and secondary/contingency waste storage areas on the Prelude FLNG facility to provide sufficient capacity for all anticipated activities. Waste storage on the FLNG facility has a capacity to accommodate approximately 14 days of waste accumulation during normal operations. Additional temporary laydown areas for waste storage may be established during specific campaigns as required, e.g. during major maintenance. Waste receptacles are back loaded onto supply vessels via crane for transportation to onshore facilities.

Low level Naturally Occurring Radioactive Materials (NORMs) may also occur in sludges, scale and sands typically associated with the inlet/separator facilities, filters and low points within the hydrocarbon processing system. The NORM nuclides of primary concern in oil and gas production are Radium-226 and Radium-228. These decay into various radioactive progeny, before becoming stable. Radium-226 and Radium-228 belong to the two principal radioactive decay series associated with NORMs in the oil and gas industry (Uranium-238 and Thorium-228 respectively) (APPEA 2002 and IOGP 2008). Such waste streams are removed from the facility for appropriate treatment/disposal onshore.

During process related maintenance activities and opening of vessels, potentially mercury-contaminated guard beds, materials, filters, sludges and sands may also be recovered. As with other hazardous wastes, these will be assessed, handled and stored appropriately then sent to shore for proper disposal.

Shell's extensive operational experience indicates most accidental releases of wastes to the marine environment are typically relatively small scale and infrequent events. The potential environmental impacts from the accidental loss of solid objects to the marine environment depends on the nature and amount released, and the sensitivity of the environmental receptors that may be impacted. Some solid objects (e.g.

paper, cardboard) will readily degrade in the marine environment and pose little environmental risk. Other solid objects are more persistent in the environment, particularly plastics.

Minor releases of liquid hydrocarbons (e.g. equipment and generator fuels, lubricants, and hydraulic fluids) and non-hydrocarbon liquids (e.g. operation chemicals, brine, sewage, cooling agents and paints) have the potential to occur from:

- mechanical failure of, or damage to, equipment, such as tanks, hoses, quick disconnect systems or pipework
- inadequate transfer during supply drops and handling
- dropped objects (e.g. swing loading during lifting activities).

If the spill is not contained on deck, a release to the marine environment would likely disperse rapidly within the open waters of the Activity Area restricting the potential for impacts to the vicinity of the spill location.

9.13.1.1 SCANA Hydraulic Actuator Leaks

SCANA hydraulic actuators installed on Prelude are known to be failing due to a design issue, resulting in instances of hydraulic oil leakage into the ballast tanks. The average volume of oil is minimal relative to the volume of water in the tanks (average leak volumes of <200 L, compared to 40,000 m^3 tanks). Any hydraulic oil released sits on top of the tank contents, with tank volumes managed via operational level restrictions ensuring no inadvertent oil leakage to sea. The risk of any oil discharges to ocean is therefore considered to be very low, with no evidence any release to the environment having occurred.

Rate of change alarms in the hydraulic oil tanks have been implemented, which allow for rapid identification of hydraulic oil volume changes and therefore potential leaks. All actuators are being proactively overhauled as Prelude progresses through its tank inspection program, with any residual oil removed from tanks and tanks cleaned when entries are conducted.

9.13.2 Description and Evaluation of Impacts and Risks

Table 9-104 indicates the environmental features and values and sensitivities that have been identified to be potentially affected by the minor releases that may occur during the activities covered by this EP, with further evaluation of each potentially affected receptor category provided in Sections 9.13.2.1 to 9.13.2.4. Features or values and sensitivities which could not be credibly affected by minor releases are not discussed further.

Table 9-104: Minor Releases and Waste Receptor Impact Screening Summary

	Features																		Values and Sensitivities																							
	Protected Areas			Physical		Natural				Socioeconomic							Heritage and Cultural			Physical				Natural								Socioeconomic							Heritage and Cultural		
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Habitat Critical	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect																																									

Legend:		
		Potentially affected
	×	Predicted impact

9.13.2.1 Physical Features

The introduction and establishment of pests and diseases to Australian waters pose significant ecological and socioeconomic impacts. International and domestic vessels, as well as helicopters will interact with Prelude FLNG, located ~220 km offshore from north-western Australia and ~475 km from north-north-east of Broome, WA. This interaction provides a potential vector for the translocation of pests and diseases to Australian waters, should the facility host any.

In northern Australia, biosecurity risks are particularly pronounced due to the region's unique climate, diverse ecosystems, and geographical location. The tropical environment and seasonal weather patterns create ideal conditions for the proliferation of pests and diseases. Additionally, the region's agricultural activities are vulnerable to these threats.

However, with the stated controls in place to minimise the potential risk of translocating pests and diseases during the activity, the likelihood of introducing pests and diseases that could establish and impact the Australian mainland is considered extremely remote. The residual risk to physical features is ranked Dark Blue (Likelihood: Extremely Remote A, Consequence: Major, Residual Risk: Dark Blue (Table 9-105)).

9.13.2.2 Physical Values and Sensitivities

9.13.2.2.1 Water and Sediment Quality

Minor releases may cause temporary and localised reductions in water quality near the release location, with the effects reducing as the constituents of the release are naturally dispersed by currents and diluted in the water column. Volumes of hazardous components (such as residual paint in cans) that may enter the marine environment are generally low and, given the water depths in the Activity Area and the dynamic nature of the offshore receiving environment, water quality is expected to rapidly and effectively recover to ambient conditions with distance and time from the release.

Due to the water depths in the Activity Area, most minor releases of liquids or buoyant solids are unlikely to have any effects on seabed sediments. Heavier materials that reach the seabed may locally decrease sediment quality, including through direct exposure to any hazardous components and/or to degradation products over time. Considering the relatively small scale of most potential minor releases, effects can reasonably be anticipated to be highly localised. The sediment substrates in the Activity Area are widely distributed through the region and the area that might be affected is negligible.

The residual risk to physical values and sensitivities is ranked Dark Blue (Likelihood: Likely E, Consequence: Slight, Residual Risk: Dark Blue (Table 9-105)).

9.13.2.3 Natural Features

9.13.2.3.1 Timor Province Bioregion

Minor releases can impact pelagic biota through physical interaction (e.g. entanglement) or localised contamination of water and toxic effects. Materials that are heavy enough to reach the seabed also have the potential to disturb benthic habitats, alter substrate type and/or adversely affect benthic fauna due to the release of residues or decomposition of materials. Potential effects to EPBC Act listed species are described in Section 9.13.2.4.1.

Habitats and benthos within the Activity Area are generally not considered to be sensitive or of high conservation value and are well represented in the region. The area of seabed disturbance due to release of a heavier solid would largely be restricted to the size of the object dropped and potential impacts to the benthic communities very localised. Given the nature of substrates and associated infauna and epifauna within the Activity Area (Sections 7.7.7 and 7.7.8) and their widespread regional distribution, the scale of impact to benthic communities is expected to be negligible.

The release of hazardous materials may expose marine biota to potential toxic effects. However, given the anticipated rapid dispersion and/or dilution of minor hazardous releases in the open ocean environment of the Activity Area, algae and marine fauna are likely to encounter hazardous spills at toxic concentrations for only short durations, and within a highly localised area. Therefore, population-level effects are unlikely to occur from small spills of hazardous materials.

There is a risk that persistent solid materials released into the marine environment, particularly plastics, may cause adverse effects in pelagic fauna through ingestion or entanglement as well as contributing to the overall amount of plastics in the ocean, which can have various impacts on marine fauna as they accumulate in the food chain. Considering the general absence of important habitats in the Activity Area, lack of fauna aggregations and generally widespread distributions of the species that may encounter minor releases, the proportion of any fauna population that might be affected by the small volumes potentially released is expected to be very low. The residual risk to natural features is ranked Dark Blue (Likelihood: Likely E, Consequence: Slight, Residual Risk: Dark Blue (Table 9-105)).

9.13.2.4 Natural Values and Sensitivities

9.13.2.4.1 Threatened, Migratory, Marine and Cetacean Species

There are no aggregation sites for EPBC Act listed species in or near the Activity Area and the number of any species that may occur near a minor release at the time of the release is likely to be very low. Air breathing fauna such as marine mammals and reptiles are unlikely to be adversely affected by localised short-term reductions in water quality or to suffer significant toxicity effects. Sharks and rays may be more vulnerable. However, due to the small volumes of hazardous materials that may be released and the rapid dispersion and dilution that is expected to occur following release, an animal would need to remain in very close proximity to the release location beside/under a vessel or the facility during and immediately following the release to be exposed to concentrations likely to result in toxic effects on any fauna.

Marine debris has been identified as a threat for a range of threatened or migratory fauna species, including marine turtles, birds, marine mammals and sharks and rays, and is listed as a key threatening process under the EPBC Act. Persistent solids (e.g. plastics) are of particular concern, as the threat to fauna may remain long after the release. Large plastics have the potential to break down to form microplastics, due to wave, current and UV action, which can be absorbed and ingested by fauna and bioaccumulate (DAWE 2021). The National Plastics Plan (DAWE 2021) supports global action to address marine plastic debris, including implementing the Threat Abatement Plan (TAP) for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (CoA 2018). This TAP identifies EPBC Act listed species for which there are scientifically documented adverse impacts resulting from marine debris. Potential impacts of marine debris on key fauna species include (CoA 2018):

- entanglement, potentially resulting in restricted mobility, drowning, starvation, smothering and wounding
- ingestion (particularly of plastics) leading to physical blockage of digestive systems, leading to starvation
- acute or chronic toxic effects.

None of the threatened or migratory fauna species identified by the TAP as impacted by marine debris have BIAs that overlap the Activity Area and the number of any of these species likely to be exposed to minor releases is very low. While not specifically identified as an impacted species in the TAP, the whale shark is known to have ingested plastics (CoA 2018) and is known to occur in the Activity Area, although their BIA is not within the Activity Area. However, their presence is transitory and of short duration; it is expected that whale shark presence would not comprise of significant numbers given there is no main aggregation area within the vicinity, and so the species would not have a substantive risk impacting them on a population level.

Comprehensive management is in place to reduce the risk of debris (and other materials) being accidentally released to sea during the activity (Table 9-106). With the management that will be implemented, the potential for minor releases to result in any significant impacts at a population level for any threatened, migratory, marine or cetacean species is considered to be extremely remote.

The residual risk to natural values and sensitivities is ranked Dark Blue (Likelihood: Likely E, Consequence: Slight, Residual Risk: Dark Blue (Table 9-105)).

9.13.3 Risk Assessment Summary

Table 9-105: Minor Releases and Waste Evaluation of Residual Risks

Environmental Receptor	Consequence	Likelihood	Residual Risk
Evaluation – Unplanned Risks			
Protected Areas	N/A	N/A	N/A
Physical Features	Major	A	**Dark Blue**
Physical Values and Sensitivities	Slight	E	**Dark Blue**
Natural Features	Slight	E	**Dark Blue**
Natural Values and Sensitivities	Slight	E	**Dark Blue**
Socioeconomic Features	N/A	N/A	N/A
Socioeconomic Values and Sensitivities	N/A	N/A	N/A
Heritage and Cultural Features	N/A	N/A	N/A
Heritage and Cultural Values and Sensitivities	N/A	N/A	N/A

9.13.4 ALARP Assessment and Environmental Performance Standards

Table 9-106: Minor Releases and Waste - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	Eliminate waste generation.	No	It is not feasible to operate the offshore facilities and vessels without generating wastes.	N/A	N/A	N/A
Elimination	Eliminate lifting in field.	No	Elimination of lifting would reduce the risk of dropped objects, however, lifting activities are required to conduct the activities covered under this EP (e.g. IMR, transfer of supplies). Lifting is therefore an integral activity and cannot be eliminated completely. Hence, this control is not considered feasible.	N/A	N/A	N/A
Elimination	Eliminate ROV activities.	No	Eliminating ROV use would reduce the potential for accidental hydrocarbon releases to the marine environment due to equipment failure. IMR and other activities require the use of ROVs, these contain negligible volumes of hydrocarbons and as they are regularly inspected and maintained, the risk of failure is very low. The use of ROVs is essential to efficiently assure ongoing asset integrity and safety and therefore outweighs any minor environmental risk involved in deploying them. Hence, this control is not reasonably practicable and would not result in a net reduction in environmental impacts.	N/A	N/A	N/A
Substitution	Stock polyfluoroalkyl substances (PFAS) – free fire-fighting foam and equipment.	Yes	PFAS are persistent, bioaccumulate, and have adverse health effects on humans and wildlife. They are a forever chemical and once in the environment persist indefinitely. Safer and more environmentally friendly alternatives are available, and efforts are being made to reduce their use and release into the environment. Prelude is transitioning to stocking only PFAS free fire-fighting foam across topsides to eliminate potential for PFAS release.	11.1	Only PFAS free fire-fighting foam and equipment will be used onboard Prelude.	Vendor data sheets demonstrate fire extinguisher stocks are PFAS-free. Safety Data Sheet/s demonstrate the fire extinguishers located on the topsides are PFAS-free. Records of chemical approval in accordance with EPS 7.21.
Administrative and Procedural	Marine support vessels and the Prelude FLNG will comply with Marine Orders 94 and 95 (Marine pollution prevention – packaged harmful substances/garbage), specifically: • no planned disposal of domestic waste, solid wastes or maintenance wastes overboard from vessels (other than planned discharges permitted by this EP). • food waste discharges macerated to <25 mm particle size.	Yes	The marine assurance system is administered by Shell's marine team and, amongst other relevant requirements, ensures contract vessels comply with MARPOL, *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) and Marine Orders 94 and 95. The benefits outweigh the costs associated with implementing this control.	8.6	Marine support vessels and the Prelude FLNG will comply with Marine Orders 94 and 95 (Marine pollution prevention – packaged harmful substances/garbage), specifically: • no planned disposal of domestic waste, solid wastes or maintenance wastes overboard from vessels (other than planned discharges permitted by this EP). • food waste discharges macerated to <25 mm particle size.	Records of marine assurance of vessels carried out are consistent with the process outlined in section 10.9.4.1 including valid IOPP and ISPP certificates, as required by vessel class and type. Macerator maintenance records
Administrative and Procedural	The management and disposal of quarantine risk material will be in accordance with relevant requirements of the *Biosecurity Act 2015* (Cth).	Yes	The management and disposal of any quarantine risk material, a system control measure, in accordance with relevant requirements of the *Biosecurity Act 2015* (Cth) will reduce the risk of impact from inappropriate disposal.	11.2	Quarantine risk material is managed and disposed of in accordance with relevant requirements of the *Biosecurity Act 2015* (Cth).	Records demonstrate that any quarantine risk material is managed and disposed of in accordance with relevant requirements of the *Biosecurity Act 2015* (Cth).

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Administrative and Procedural	Shipboard Oil Pollution Emergency Plan (SOPEP) or equivalent (appropriate to class of vessel).	Yes	SOPEP (or equivalent) shall be in place for all vessels as required by their class in accordance with AMSA Marine Order 91. This system control measure enables the efficient and prompt response to hydrocarbon releases, thereby reducing potential impacts to the marine environment.	11.3	Vessels have and implement a valid SOPEP (appropriate to class) to respond to spills.	Records demonstrate a valid SOPEP (appropriate to class) is in place.
Administrative and Procedural	Waste management procedure.	Yes	Effective implementation of waste management procedures will reduce the likelihood of an unplanned release. This procedural control measure minimises environmental impacts from waste disposal through management according to waste type at the disposal facility, in accordance with licensing requirements. Topsides bins, skips and receptacles labelled to allow for commingling of similar waste streams and for easy identification of hazardous and non-hazardous wastes and to track these waste streams through to safe disposal.	11.4	Waste management procedures are in place and implemented which supports good practice and prevents accidental discharge by focusing on: • waste segregation and storage • safe handling and transport of waste • records of all waste to be disposed, treated or recycled shall be maintained, and shall include (though not limited to) quantity of waste, waste type and disposal/recycle location • waste streams shall be appropriately handled, tested, monitored and managed according to their hazard and recyclability class.	Records demonstrate implementation of waste management procedure.
Administrative and Procedural	Lifting procedures and maintenance, including inspection of lifting equipment.	Yes	Lifting, maintenance and inspection procedures are implemented for all lifting operations on Prelude. Shell Australia has a Lifting and Hoisting Manual (OPS_GEN_010724) and a Prelude specific Lifting and Hoisting Operations Supplement (OPS_PRE_010176), as well as a Prelude Lifting and Hoisting Operations Procedure (OPS_GEN_ 015990), which is mandatory for all lifting operations on the Prelude facility. The Manual and supplement specifies lifting requirements, performance standards and roles, responsibilities and competency requirements to reduce the risk of dropped objects impacting the seabed and sea infrastructure potentially resulting in damage or a loss of containment of hydrocarbons. The Prelude procedure specifies the operational controls for the planning and management of lifting activities, managing lifting appliances and lifting accessories and competency or persons performing roles associated with safe lifting and hoisting operations. Consideration of dropped objects is required as a consideration for all lifts.	11.5	Prelude lifting operations comply with the Prelude Lifting and Hoisting Operations Procedure which includes the following controls, to reduce the risk of dropped objects entering the marine environment: • defined roles, responsibilities and competency requirements • pre-lift checks and briefings • restricted operations due to weather and helicopter operations • lift plans in place with consideration of dropped objects • Recommended “No Lift’ sectors for Crane A, C and F • Risk assessment for overboard lifts using Crane A	Evidence of compliance with the Lifting and Hoisting Procedure as demonstrated by the Shell Assurance Process, including records such as: • Training records demonstrate competency requirements in accordance with the Procedure • Records of pre-lift checks and briefings • Lift plans with evidence of dropped object consideration. • Risk assessment for overboard lifts using Crane A • SAP records Incident reports demonstrate no incidents of spills or release of equipment, materials or waste to the ocean from lifting activities.

ALARP Statement

Given the impact assessment outcomes and control measures adopted under the scope of this activity, Shell considers implementing the control measures appropriate to manage the potential risk and impacts associated with minor releases and waste. Shell believes there are no feasible additional controls identified that could further reduce the impacts. Therefore, the impacts are reduced to ALARP.

9.13.5 Acceptability of Impacts

Table 9-107: Acceptability of Impacts – Minor Releases Waste

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Sub-category**			
Physical Features, Values and Sensitivities	Australian environment	No significant impacts to the Australian environment.	Yes	The transfer of waste or interaction has the potential to pose a biosecurity risk to the Australian mainland. The proposed control measures reduce the likelihood of pests or diseases entering the marine environment is extremely remote.
	Water quality	No significant impacts to water quality. Impact not expected to result in a substantial change in water quality, which may adversely impact biodiversity, ecological integrity, social amenity or human health.	Yes	Minor releases have the potential to reduce water and sediment quality at the release location. The proposed control measures reduce the likelihood of minor releases entering the marine environment is low. Additionally, the small volumes potentially released would rapidly dilute/disperse in the open ocean environment with no potential for significant impacts anticipated.
	Sediment quality	No significant impacts to sediment quality. Impact not expected to result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.	Yes	
Natural Features	Marine bioregions	No significant impacts to benthic habitats and communities. No significant adverse impact on demersal or pelagic communities,	Yes	The proposed control measures reduce the likelihood of minor releases entering the marine environment is low. Given the remote location and the lack of significantly diverse benthic communities

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	Sub-category			
		populations, habitats or spatial distribution of a species. No substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution.		or habitats that support the congregation of threatened or migratory species within the Activity Area, any accidental release of material to the environment would not be expected to interact with or affect a significant number of threatened or migratory MNES species. All vessels will meet MARPOL standards and will be compliant with these for waste management procedures. Internal controls to manage storage and handling (including lifting) activities and reduce the likelihood of materials being accidentally released to the marine environment will also be implemented. Management of this aspect is not inconsistent with relevant conservation advice, recovery plans and threat abatement plans (Table 8-1). Consistent with Table 8-1, the unlikely event of impact to individuals of marine species is not considered to cause a significant impact to EPBC act listed species or injury and/or mortality of cetaceans..
Natural Values and Sensitivities	Threatened, migratory, marine and cetacean species	No mortality or injury of cetaceans. Management of aspects of the activity must align with conservation advice, recovery plans and threat abatement plans (Table 8-1). No significant impacts to EPBC Act listed threatened, migratory, marine or cetacean species.	Yes	

The assessment of risks from minor releases and waste determined the residual risk rating of Dark Blue (Table 9-105). The acceptability of the risks of impacts from minor releases and waste associated with the petroleum activities has been considered in the following context.

Principles of ESD

The potential risks of impacts from minor releases and waste are consistent with the principles of ESD because:

- The environmental values/sensitivities within the Activity Area are not expected to be significantly impacted
- The precautionary principle has been applied to the risk assessment.

Relevant Requirements

Managing the potential risks of impacts from minor releases and waste are consistent with relevant legislative requirements, including:

- MARPOL Annex V as ratified by the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth)
- *Navigation Act 2012* (Cth) and Protection of the Sea (Prevention of Pollution) Act 1983 (Cth):
  - Marine Order 94 – Marine pollution prevention – packaged harmful substances
  - AMSA Marine Order 95 – Marine pollution prevention – garbage
- Biosecurity Act 2015 (Cth)
- Policies, strategies, guidelines, conservation advice, and recovery plans for threatened species (Table 9-108).

Matters of National Environmental Significance

Threatened and Migratory Species

The evaluation of risks considers that no significant risks to threatened and migratory species are predicted to result from minor releases and waste because of the limited number of fauna that could potentially be impacted in the unlikely event of a release.

Table 9-108 summarises the alignment of the petroleum activities with management plans, recovery plans and conservation advice for threatened and migratory fauna.

Commonwealth Marine Environment

The impacts from minor releases and waste are predicted to not exceed any of the significant impact criteria for the Commonwealth Marine Area listed in Table 8-1; as such, it is considered that the aspect does not pose a credible risk of significant impact to the Commonwealth marine environment.

Table 9-108: Summary of Alignment of the Risks from the Waste Aspect of the Prelude Petroleum Activities with Relevant Requirements for EPBC Threatened Fauna

MNES	MNES Acceptability Considerations	Demonstration of Alignment
Threatened and Migratory Species	Approved Conservation Advice on *Balaenoptera borealis* (sei whale) (DoE 2015c)	Waste generated during the petroleum activities described in this EP will be managed in accordance with standard maritime requirements, international conventions (MARPOL), relevant Marine Orders and Shell's internal management system requirements. This management reduces the likelihood of the accidental release of hazardous and non-hazardous wastes into the marine environment.
	Conservation Advice on fin whale (*Balaenoptera physalus*) (TSSC 2015b)	
	Conservation management plan for the blue whale: A recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015–2025 (CoA 2015a)	

MNES	MNES Acceptability Considerations	Demonstration of Alignment
	Conservation advice on humpback whale (*Megaptera novaeangliae*) (DoE 2015b)	The frequency, quantities and nature of wastes that may be accidentally released into the environment are unlikely (C) to result in significant impacts to threatened/migratory species or the Commonwealth Marine Environment (Table 8-1).
	Significant impact guidelines for Critically Endangered, Endangered, Vulnerable and Migratory species (Table 8-1)	
	Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA 2017b)	
	Approved conservation advice for *Dermochelys coriacea* (leatherback turtle) (TSSC 2008a)	
	Conservation advice on whale shark (*Rhincodon typus*) (DoE 2015e)	
Commonwealth Marine Area	Significant Impact Guidelines for the Commonwealth marine environment (Table 8-1)	
	Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (CoA 2018)	

External Context

No objections or claims have been raised by relevant persons to date regarding minor releases or waste. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see Section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4

Internal Context

Shell also considered the internal context, including Shell's Waste and Circularity Strategy, environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented, are consistent with the outcomes from consultation for the petroleum activity and Shell's internal requirements.

Acceptability Summary

The assessment of potential risks from minor releases and waste determined the residual risk rating to be Dark Blue (Table 9-105). The acceptability of the impacts and risks from minor releases and waste associated with the activity have been considered in the context of:

- the established acceptability criteria
- ESD
- relevant requirements
- MNES
- external context (i.e. relevant persons claims or objections)
- internal context (i.e. Shell requirements).

Shell considers residual risks of Dark Blue or lower to be inherently acceptable if they meet legislative and Shell requirements. The discussion above demonstrates that these requirements have been met in relation to the minor releases and waste aspect.

Shell considered the risk of impacts from minor releases and waste associated with the petroleum activities to be ALARP and acceptable.

9.13.6 Environmental Performance Outcome

EPO #	EPO	Measurement Criteria
2.1	No injury or mortality of threatened, migratory or cetacean species associated with the Activities.	Reports of injury or mortality of EPBC listed threatened, migratory or cetacean species associated with the Activities sent to NOPSEMA and DCCEEW in accordance with requirements outlined in Table 10-13.
11.1	No incidents of spills or the release of equipment, materials or waste to the ocean from the activity	Incident reports demonstrate no incidents of spills or the release of equipment, materials or waste to the ocean from the activity.

9.14 Emergency Events

9.14.1 Scenario Context

Scenarios that may lead to an emergency event[90] include:

- Loss of containment (LOC) of well fluids from subsea infrastructure (e.g. production wells, manifolds, flowlines, or risers) leading to the uncontrolled release of Prelude condensate.
- LOC during FLNG product storage and offloading (LNG, LPG, or condensate)
- LOC of heavy fuel oil to sea from marine vessels or product offtake tankers
- LOC of diesel during refuelling or following a collision between any marine vessels operating in the field.
- Accidental discharge of hazardous liquids or hazardous liquid wastes (e.g. MEG, amine) during bulk liquid transfers or lifting operations.

Table 9-109 shows the maximum credible spill volumes for each of the scenarios outlined above, calculated using AMSA's Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities (AMSA 2015). Further description of the scenarios that would result in the greatest release volumes of the different oil types (i.e. condensate and diesel) is provided below. Additional tables are located in the appendix that outline the extent of travel, timeframes and percentage probabilities for different oil phases, including likelihood of impact on receptors for Prelude worst case scenarios (Appendix E).

9.14.1.1 LOC from Subsea Infrastructure

Prelude subsea infrastructure includes seven production wells, two production manifolds and one drill centre, four production flowlines, a riser manifold and risers as well as the well control umbilical. LOC could occur from any of these facilities due to a dropped object, corrosion, erosion, human error or external environmental events that could exceed the design tolerance of any of the components of this system.

Loss of well control (LOWC) incidents are known to be associated with the largest potential for environmental harm due to the large volumes of hydrocarbons contained in the reservoir and the considerable amount of time it requires to drill an offset relief well and stop the flow of reservoir fluids to the environment. LOWC incidents are most likely to occur during well drilling or workover when there is an open path for well fluids from the reservoir to surface, and reliance is on control systems and operators to detect an abnormal situation in its incipient stages to prevent it from escalation. Drilling or workovers of this nature requiring a MODU are not considered in scope of this EP and any future requirements will be addressed in standalone campaign specific EPs and associated documentation.

In the production phase, the source control responses will be different from drilling and completion operations. During the drilling phase, prior to Xmas tree installation, a capping stack can form a major component of a source control response plan; this is no longer the case. The current configuration of the Prelude production wells, with subsea Xmas trees installed and connected to subsea flowlines, negate the use of a capping strategy for operations. Only for well activities where the Xmas tree is removed is this a viable consideration. Furthermore, in the event of the complete removal due to major damage of the production tree, debris clearance and capping activities are not considered viable as there would not be any infrastructure to land the cap on and secure it for well control operations.

Shell engineering standards require a range of features which manage the risk of a LOWC to very low levels. However, there is a possibility that a LOWC may occur during the activities covered by this EP. While the likelihood is very small, a complete LOWC (a well blowout) has the potential to release large volumes of condensate into the environment.

In accordance with NOPSEMA guidance on oil spill risk assessment for Environment Plans (Guidance note N-04750-GN1344), the full range of scenarios up to and including worst case have been evaluated irrespective

[90] Emergency events are incidents that result in the mobilisation of the Shell emergency response team and/or Incident Management Team (West)(IMT(W).

of their probability for occurrence. Revalidation of Prelude's worst case discharges including LOWC has been conducted.

The worst-case discharge scenario is based on discharge into ocean from the subsea wellhead and tree through the 7" production tubing. This scenario could eventuate from damage to the tree by a vessel or anchor, or during well integrity work performed by a LWI vessel. The P5 well has been selected as worst-case potential discharge rate potential, with the scenario assuming critical failure of all BOP barriers with TRSSV valve 100% open. At the time of discharge all other wells are assumed to be shut-in immediately to ensure maximum discharge potential for the P5 well.

Discharge has been assessed over an 80-day duration, aligning with the time required to drill a relief well. The modelled well fluids flow rate and therefore the worst credible discharge through the 7" production tubing, is 2497 bbl (397 m^3) per day yielding a total released volume of 200,015 bbl (31,800 m^3). This volume has been used for oil spill predictive modelling (Section 9.14.1.9) and the risk assessment presented in this section of the EP.

All potential release scenarios were evaluated, including the 9-5/8" x 10-3/4" casing release at the seabed during a subsea well workover, as referenced in the 2020 revision of the Prelude EP. This scenario was deemed not credible as it is only applicable during a well workover using a MODU, which is out of scope of this EP (Section 6.10.5).

Industry statistics indicate the likelihood of a major release due to a well blowout are very low. Most loss of well control incidents do not result in a worst-case well blowout scenario and typically release relatively small masses of hydrocarbons. The likelihood of a well blowout during operations (production) is considerably lower than a loss of containment from an exploration well, as are the release masses (Figure 9-15).

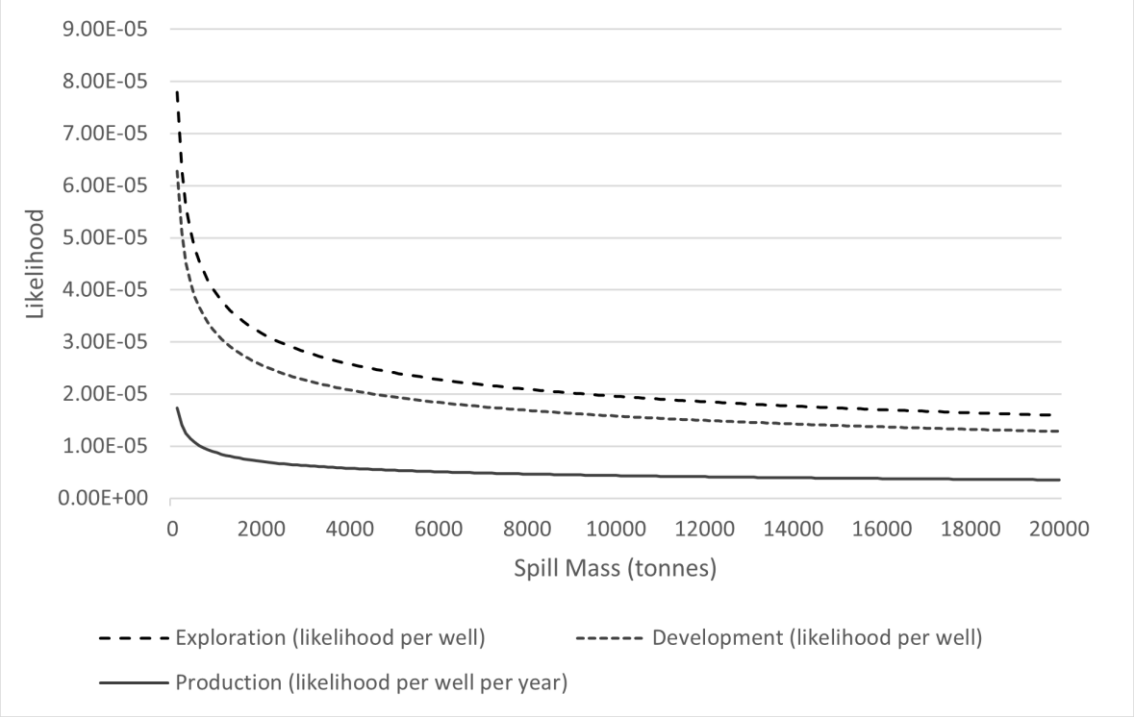


Figure 9-15: Estimated Likelihood and Mass of Well Blowouts for Exploration, Development and Production Wells (after Det Norske Veritas 2011)

Shell has extensive experience with safe and environmentally responsible production operations worldwide. Shell has developed a detailed understanding of the Prelude field through years of stable operation, and reservoir data. The offshore oil and gas industry has improved environmental performance since the Macondo and Montara catastrophes, and Australian regulations require that all environmental risks be managed to a level that is ALARP and acceptable, as demonstrated in this EP. All wells will be operated in accordance with an accepted WOMP that meets the requirements of the OPGGS Act.

Shell has determined the worst-case credible spill scenario that could occur during the activities within the scope of this EP. This modelled scenario is a complete well blowout, resulting in an 80-day uncontrolled release of 397 m^3 per day, with a total release volume of 31,800 m^3 of condensate. The duration is based on the credible worst-case time required to regain control of the well (by drilling of a relief well) and the volume is based on the maximum credible rate of release derived from the proposed well design and reservoir characteristics. The release location is subsea at Prelude well P5. While this scenario is very unlikely, using this scenario of worst-case credible spill from subsea infrastructure as the basis for the risk assessment provides an environmentally conservative assessment of the potential impacts and risks posed by the potential spill release scenarios during the Activity. Hydrocarbon characteristics for Prelude condensate are further detailed in Section 9.14.1.7.1.

All other releases from subsea infrastructure will be orders of magnitude smaller in volumes lost to sea compared to the uncontrolled production well release scenario through the 7" production tubing. These smaller release scenarios have not been discussed or modelled further. The maximum credible spill volumes for a LOC from subsea infrastructure is described in Table 9-109.

9.14.1.2 LOC from Product Storage and Loading

The liquid product streams on Prelude are LNG, LPG (propane and butane) and condensate. During production these are rundown to their respective cargo storage tanks within the substructure and stored at atmospheric pressure. The substructure is double hulled on each side extending over the full length of the storage tanks. LNG, LPG and condensate storage tanks are located inboard of segregated ballast tanks covering the full length of the storage area and are separated from each other by either a void space or a ballast tank. In addition, the tanks are protected from the topsides hazards by a main deck designed to withstand explosion overpressure, jet fire and cryogenic spills. A heating system is installed to heat the transverse cofferdams and the upper portion of the centreline water ballast tanks surrounding the cargo tanks to maintain the temperature of the structure and prevent brittle failure.

LNG or LPG leaks from the topsides process modules or any hydrocarbon release from the cryogenic areas of the plant are directed to sea to protect the facility from damage due to cryogenic spills and prevent process safety incidents and escalation. Topsides condensate spills on the FLNG, however, are designed to be captured and contained in the drainage system and reclaimed back into the process where possible or disposed of appropriately. Only a single product stream is offloaded at a time. LOC of LNG and LPG during storage and loading are further described in Section 9.14.1.2.1 and Section 9.14.1.2.2.

9.14.1.2.1 LOC from LNG and LPG Storage and Loading

The FLNG Ship Collision Study and Collision Analysis for Substructure indicate a remote to extremely remote likelihood of ship collision as detailed in the Prelude FLNG Safety Case (Shell Australia 2022). The overall collision frequencies are dominated by the contribution of the low energy on approach supply and product offtake vessels, which would cause no breach of the outer hull but localised damage only.

For a loss of containment of LNG, LPG or condensate product from a single cargo tank to occur, collision energy levels between 193 and 500 MJ should be imparted to the FLNG hull. Energy levels greater than 500 MJ could cause extensive hull damage with release of large volumes of products. These high-energy impacts could only be associated with large passing vessels travelling at cruise speed.

Based on known shipping routes and annual traffic through the Prelude area, the annual frequency of collisions resulting in single storage tank failure and loss of containment is estimated at 4.7E-05/year and the catastrophic FLNG vessel failure frequency is 3.8E-05/year (Shell Australia 2022).

Smaller volume LNG and LPG spills could occur during LNG or LPG loading. LNG, LPG and condensate is regularly transferred to offtake tankers with the following approximate frequency:

- LNG – every week
- LPG – every 4–6 weeks
- Condensate - every 2 - 4 weeks

An LNG or LPG spill could result from an inadvertent move of the FLNG or LNG/LPG tanker beyond the design tolerance of the loading arms, causing arm disconnection, parting or failure; material failure due to corrosion, erosion; temperature embrittlement; overpressure or dynamic loading from product fluids, adverse weather.

At the end of an LNG/LPG carrier loading, the loading arms are emptied forward to the carrier. Then the LNG/LPG offloading header and offloading arm manifolds are drained to the LNG/LPG storage tanks assisted by nitrogen purge. In the event of an emergency during loading, the loading header is emptied to the tanks by gravity.

LNG and LPG are gases at ambient temperatures, hence any LOC from the cargo tanks or during loading will ultimately result in loss to atmosphere and therefore cause no damage to the marine environment. The main concern with such events is the potential for fires or explosions presenting risks to personnel and property and these are addressed in the Prelude FLNG Safety Case. Environmental risks related to such releases are therefore considered non-credible and have not been discussed further.

9.14.1.2.2 LOC from Condensate Storage and Loading

Six atmospheric pressure condensate storage tanks are located in the aft section of the FLNG hull. Each tank has a capacity of 21,054 m^3 at 95% full and is supplied with two offloading pumps. During offloading mode all twelve offloading pumps are expected to be in operation, delivering condensate at a rate of 5,000 m^3/hr to the condensate tanker. This allows offloading of up to 120,000 m^3 of condensate (net total pumpable condensate tanks storage capacity) in 24 hours.

A stern tandem offloading arrangement for the discharge of condensate is provided at the aft end of Prelude. Condensate tankers are designed to be moored in the conventional manner for Single Point Mooring (SPM) bow mooring terminals with a standard OCIMF single braided (DN 400/DN 500) floating hose string deployed to the standard mid-ship manifold. Berthing utilises a hawser and hold-back support vessel rather than dynamic positioning. The condensate floating hose is stowed on an aft hose reel for controlled deployment and recovery. After offloading the remaining condensate in the hose is transferred back to the condensate tank by N_2 purge. A washing system is provided to allow washing of the hose back to the slops tanks to minimise build-up of waxy deposits within the hose.

Condensate is a liquid at ambient temperature and pressure. It is comprised of low molecular weight hydrocarbons and has similar characteristics as light diesel fuel. It is typically volatile and evaporates readily. However, Prelude condensate has a significant waxy component which may persist after the volatile portion evaporates. Hydrocarbon characteristics for Prelude condensate are further detailed in Section 9.14.1.7.1.

Condensate containment losses from FLNG operations have been estimated as follows:

- Up to 10 m^3 from inadvertent disconnection of a coupling or flange at the topsides process modules and failure to contain by spill trays and the drain system.
- Up to 1,000 m^3 for condensate offloading operation by floating hose. At a loading rate of 5,000 m^3 per hour, these quantities reflect a major loss of containment from rupture of loading hose and failure to respond within 12 minutes.
- Release of cargo due to a high impact vessel collision and breach of hull and storage tank containment. A rupture of two pressure condensate tanks is considered credible releasing 42,000 m^3 of condensate released over a period of 2 hours.

The last scenario is considered as the worst-case credible scenario for LOC of condensate during storage and loading and has been modelled for impact assessment purposes and is further described in Table 9-109.

9.14.1.3 LOC of Heavy Fuel Oil

The product offtake tankers could potentially carry heavy fuel oil (HFO) as fuel. Whilst vessels are prohibited from HFO use within the PSZ, there is potential that offtake tankers may hold HFO in holding tanks. A HFO spill may result from a tanker collision with other vessels, such as other tankers or an attendant vessel during berthing or unberthing operations as a result of human error, adverse sea/ weather conditions, loss of navigation aid systems, mechanical breakdown, miscommunication or tug failure.

Given the average volume of HFO stored in LNG carriers (up to 5,000 m^3) and the low energy collision credible during berthing/ unberthing, a 1,000 m^3 HFO spill was modelled. This is considered highly conservative given

impact energy is highly unlikely to result in a HFO tank breach. The probability of this event occurring is considered remote, as such incidents have not been recorded within Shell, although they have been observed elsewhere in the industry. Additionally, vessel operations within the PSZ are restricted from using HFO, further reducing the probability.

HFO contains a high proportion of hydrocarbon compounds that will not evaporate at atmospheric temperature, therefore persisting in the marine environment and weathering over time. Hydrocarbon characteristics for HFO are further detailed in Section 0.

9.14.1.4 LOC of Diesel

A diesel spill to the Activity Area could occur as an outcome from:

- LOC during diesel transfer from the supply vessel to the FLNG facility; or during refuelling of the pilot tugs, or
- following a collision between any marine vessels, including the FLNG facility, operating in the field.

Diesel will be loaded onto the FLNG facility from support vessels approximately once per month. This refuelling operation takes at least 4 hours per to complete. A spill could occur as a result of failure of any engineering controls (e.g. hose rupture, coupling failures, tank overflow). However, historically the volume lost to sea in such incidents is typically less than 160 L or 1 bbl. (Det Norske Veritas 2011) and potential further losses are reduced by visual observations, shutdown of pumps and automatic closure of safety valves.

The risk of a spill from vessel-to-vessel collision depends on the severity of impact i.e. the speed and orientation of the vessels during the event. The worst-case scenario is where one of the vessels is 'hit' from the broadside by another vessel moving at near full speed resulting in a puncture of the diesel tanks below the waterline.

Prelude marine support vessels have diesel storage capacities of around 1,000 m^3, spread across multiple tanks. Pilot tugs carry similar or smaller diesel inventories onboard. The likelihood of collision between supply and support vessels and any other vessels in the field is considered remote given the low frequency of vessel collisions in ports resulting in fuel loss of containment (Det Norske Veritas 2011), and is further reduced by the fact that the Activity Area is significantly less busy than any other Australian or international port.

Shell has determined that the worst-case credible diesel spill scenario is from a supply vessel collision with the FLNG facility of magnitude such that a breach of the hull and damage to its biggest diesel storage tank would occur. The tank is located in the FLNG facility substructure and has a capacity of 750 m^3. It has been conservatively assumed for the purposes of spill modelling that in this scenario the whole tank inventory would be lost to sea. The likelihood of this event happening is estimated as remote as such incidents have not been recorded within Shell, although they have been observed elsewhere in the industry. Smaller volumes of diesel could be spilled during refuelling activities or accidental vessel collision in the Activity Area. These scenarios have not been assessed as they would be within the footprint of the larger spill volume.

Marine Diesel is a mixture of volatile and persistent hydrocarbons with low proportions of highly volatile and residual components further described in Section 9.14.1.7.3.

9.14.1.5 LOC of Hazardous Liquids

Accidental loss to sea of hazardous liquids other than hydrocarbons (e.g. amine, MEG, hydraulic/lube oil) could occur at the Prelude location due to any of the following events:

- accidental opening of an isolation valve during normal operations
- hose failure or failure to isolate inventory during bulk liquid transfers
- lifting operations between marine vessels, including the FLNG
- adverse weather conditions resulting in dislodgement/ failure of storage vessel(s).

The worst-case spill scenarios were modelled for amine and MEG, given these are the most toxic of the hazardous liquids. Whilst credible, the release of other chemicals have not been further assessed as they fit within the modelled extent and impact of MEG and amine. The credible scenarios are summarised as follows:

- a 1-hour release of 1,000 m^3 of amine (using AdapT as an analogue 43% Methyldiethanolamine (MDEA), 7% Piperazine and 50% seawater) at sea surface following a complete rupture of the FLNG amine storage tank
- a 1-hr 6,000 m^3 release of MEG (80% pure MEG and 20% seawater) at sea surface following a complete rupture of the FLNG MEG storage tank.

9.14.1.6 Maximum Credible Spill Volumes

The worst case credible maximum spill volumes for Prelude emergency events are described in Table 9-109.

Table 9-109: Emergency Events: Maximum Credible Spill Volumes

Incident Type	Scenario	Maximum Credible Volume (m^3)
LOC from Subsea Infrastructure	A long term (80-day) uncontrolled, release of Prelude condensate from a subsea wellhead during operations through the 7" production tubing. A release continuing for 80 days is considered the worst-case LOWC scenario based on a conservative estimate of the time required to mobilise a drilling rig and complete a relief well.	31,800
Vessel Collision (Prelude Condensate)	A short duration (2-hours) surface release of Prelude condensate due to a high impact vessel collision leading to a breach of hull and storage tank containment during product storage and loading. A rupture of two pressure condensate tanks releasing full inventory is considered credible releasing 42,000 m^3 of condensate over a period of 2-hours.	42,000
Vessel collision (HFO)	A short duration (1-hour) surface release of HFO due to high impact vessel collision with other vessels such as other tankers or an attendant vessel. Given the average volume of HFO stored in LNG carriers (up to 5,000 m^3) and the low energy collision credible during berthing/unberthing, a 1,000 m^3 HFO spill was conservatively modelled.	1,000
Vessel Collision (MDO)	A short duration (1-hour) loss of containment of diesel from a supply vessel collision with the FLNG facility such that a breach of the hull and damage to its biggest diesel storage tank would occur resulting in a surface release of 750m^3 of Marine Diesel over 1-hour. Smaller volumes of diesel could be spilled during refuelling activities or accidental vessel collision in the Activity Area. These scenarios have not been assessed as they would be within the footprint of the larger spill volume.	750
LOC of Hazardous Liquids (amine, MEG).	There are two worst case scenarios for the LOC of hazardous liquids: • a 1-hour release of 1,000 m^3 of amine (43% Methyldiethanolamine (MDEA), 7% Piperazine and 50% seawater) at sea surface following a complete rupture of the FLNG amine storage tank. • a 1-hr 6,000 m^3 release of MEG (80% pure MEG and 20% seawater) at sea surface following a complete rupture of the FLNG MEG storage tank. LOC of other hazardous liquids hydraulic/lube oil have not been assessed as they fit within the footprint of the worst-case scenarios.	Amine – 1,000 MEG – 6,000

9.14.1.7 Hydrocarbon and Chemical Characteristics

The hydrocarbon characteristics for the Prelude worst case Emergency events are further detailed in Sections 9.14.1.7.1 to 9.14.1.7.4.

9.14.1.7.1 Prelude Condensate

Prelude condensate is a low-viscosity (1 cP) and low-density (0.7374 g/cm^3) mixture of hydrocarbons whose properties will result in rapid initial spreading at the water surface under calm conditions, or entrainment under high wind/wave conditions (Table 9-110). The mixture is mostly composed (~100%) of volatile hydrocarbon

compounds that would evaporate completely over time if exposed to the atmosphere, leaving a residue of <0.01% of the initial oil mass that will not evaporate (Table 9-111). 77.9% (BP<180°C) by mass is highly volatile and would evaporate within 6 to 12 hours if exposed to the atmosphere. A further 12.7% (180 °C < BP < 265 °C) would evaporate within 24 hours if exposed to the atmosphere. Thus, approximately 91% of the spill mass would likely evaporate within 24 hours under high levels of sunlight and with exposure to the atmosphere as a thin film. Soluble aromatic hydrocarbons contribute around 12% of the mass of the unweathered mixture but much of this contribution is by the highly volatile mono-aromatic compounds that will volatize within hours of release from the water surface or the upper water column.

The low pour point of the whole condensate (-42°C) indicates that the unweathered mixture will remain liquid over the annual temperature range in Northern Australian waters. The whole mixture has low asphaltene content (<0.05%), indicating a low tendency to take up water and form water-in-oil emulsions over the weathering cycle.

The condensate has little to no residual that will not evaporate, with these hydrocarbons having a pour point lower than prevailing sea temperatures, suggesting that the residues will solidify and float as sheets/flakes on the sea surface. These solid residues typically have low environmental toxicity (e.g. paraffins) and are subject to microbial and photo-degradation over time.

Table 9-110: Physical Properties of Prelude Condensate

Physical Properties	Prelude Condensate
Density (g/cm^3)	0.7374 (at 15° C)
API	61.08
Dynamic viscosity (cP)	1.007 (at 20° C)
Pour point (° C)	-42
Hydrocarbon property category	Group I
Hydrocarbon persistence classification	Non-Persistent Light Oil

Table 9-111: Boiling-point Breakdown of Prelude Condensate

Oil Type	Volatiles (%)	Semi-Volatiles (%)	Low Volatiles (%)	Residual (%)	Aromatics (%)
Boiling point (°C)	<180 C4 to C10	180–265 C11 to C15	265–380 C16 to C20	>380 >C20	Of whole oil <380 BP
	Non-persistent			*Persistent*	-
Prelude Condensate	77.9	12.7	9.34	0	12

9.14.1.7.2 HFO

HFO is classified as a highly persistent oil (group III) with a density of 1.001 and a high viscosity (22,800 at 15° C). The characteristics of HFO are summarised in Table 9-112. HFO contains a high proportion (73.1% by mass) of hydrocarbon compounds that will not evaporate at atmospheric temperature. These compounds will persist in the marine environment as residue until degraded by microbes and photo-chemical reactions. The whole oil has an asphaltene content of 13%, indicating a relatively high propensity for the mixture to take up water to form water-in-oil emulsion over the weathering cycle. The high viscosity of the HFO indicates that slicks of this oil would not be easily broken apart to entrain into the water column under breaking waves generated by low wind speeds. Evaporation rates will increase with temperature, but in general about 2.2% of the HFO mass has the capacity to evaporate within the first 12 hours (BP < 180°C); a further 12.3% could evaporate within the first 24 hours (180°C < BP < 265°C); and a further 12.3% could evaporate over several days (265°C < BP < 380°C). Selective evaporation of the lower boiling-point components will lead to a shift in the physical properties of the remaining mixture, including an increase in the viscosity and pour point. Although removal of the volatile compounds through evaporation and dissolution will result in an increase in density of

the remaining oil, the mixture is unlikely to solidify or sink as it weathers. Soluble aromatic hydrocarbons contribute approximately 2.68% by mass of the whole oil.

Table 9-112: Physical Properties of HFO

Physical Properties	HFO
Density (g/cm^3)	1.001 (at 0°C)
API	15
Dynamic viscosity (cSt)	22,800 at 15°C
Pour point (°C)	30
Hydrocarbon property category	Group III
Hydrocarbon persistence classification	High persistence/Environmentally Persistent

Table 9-113: Boiling-point Breakdown of HFO

Oil Type	Volatiles (%)	Semi-Volatiles (%)	Low Volatiles (%)	Residual (%)	Aromatics (%)
Boiling point (°C)	<180 C4 to C10	180–265 C11 to C15	265–380 C16 to C20	>380 >C20	Of whole oil <380 BP
	Non-persistent			*Persistent*	-
HFO	2.2	12.3	12.3	73.1	2.68

9.14.1.7.3 MDO

MDO is classed as a persistent light oil (Group II oil) with a density of 0.829 g/m^3 (25°C) and a very low viscosity (4cP). Being less dense than sea water and with low viscosity, it will spread quickly on the surface of the water to form a thin film (Table 9-114).

In general, about 6% of the oil mass should evaporate within the first 12 hours (BP < 180°C); a further 34.6% within the first 24 hours (180°C < BP < 265°C); and a further 54.4% should evaporate over several days (265°C < BP < 380°C) (Table 9-115). Approximately 5% of the oil is shown to be persistent. The aromatic content of the oil is approximately 3%. If released in the marine environment and in contact with the atmosphere (i.e. surface spill), approximately 41% by mass of this oil is predicted to evaporate over the first couple of days depending upon the prevailing conditions, with further evaporation slowing over time. The heavier (low volatility) components of the oil tend to entrain into the upper water column due to wind-generated waves but can subsequently resurface if wind or waves abate. Therefore, the heavier components of this oil can remain entrained or on the sea surface for an extended period, with associated potential for dissolution of the soluble aromatic fraction. Within one or two months, these residual hydrocarbons will degrade completely through the action of naturally occurring microbes.

Table 9-114: Physical Properties of MDO

Physical Properties	MDO
Density (g/cm^3)	0.829 (at 25°C)
API	37.6
Dynamic viscosity (cSt)	4 at 25°C
Pour point (°C)	−14
Hydrocarbon property category	Group II
Hydrocarbon persistence classification	Light-Persistent Oil

Table 9-115: Boiling-point Breakdown of MDO

Oil Type	Volatiles (%)	Semi-Volatiles (%)	Low Volatiles (%)	Residual (%)	Aromatics (%)
Boiling point (°C)	<180 C4 to C10	180–265 C11 to C15	265–380 C16 to C20	>380 >C20	Of whole oil <380 BP
	Non-persistent			*Persistent*	-
MDO	6	34.6	54.4	5	20-30

9.14.1.7.4 MEG and Amine

The MEG release is defined as 80% pure MEG and 20% seawater. The MEG mixture would be denser than seawater and will initially sink as a plume until the mixture becomes sufficiently mixed with ambient seawater to achieve neutral density (at ~ 30% MEG). The Amine chemical modelled is a blend of AdapT 201 and AdapT 202 and is composed of 43% Methyldiethanolamine (MDEA), 7% Piperazine and 50% seawater.

Sensitivity testing confirmed that under typical environmental conditions within the 80 km x 80 km study domain, the plumes exhibited high mobility. This rapid dispersion highlights the influence of local hydrodynamics, including ocean currents and tidal forces, in effectively diluting and transporting the MEG and amine away from the discharge location.

9.14.1.8 Modes of Environmental Impact

9.14.1.8.1 Condensate

Condensate is a ‘light’ oil with a high proportion of aromatic hydrocarbons and limited persistence. Potential impacts to marine receptors in an open ocean environment relate predominantly to effects from hydrocarbon toxicity rather than the physical oiling (smothering) that can result from heavier oils. This toxicity is primarily associated with aromatic hydrocarbons.

Aromatic hydrocarbons are generally highly volatile and, in the warm sea and air temperatures of the region, will rapidly evaporate. Consequently, any spill of these oils will weather rapidly at the surface, leaving lower amounts of less toxic hydrocarbons.

The aromatic components of the hydrocarbons are also, generally, the most soluble. Therefore, dissolution of the aromatic components into the water column will occur both when the hydrocarbons are submerged (e.g. entrained through wave action) and when the hydrocarbons are on the surface. The evaporation of aromatic components from light oil spills in tropical environments will typically be several-fold more rapid than dissolution into the ocean.

In offshore deep water spill locations, hydrocarbons at the surface present a risk to those animals that reside in or transit the surface water layer, including seabirds, cetaceans, turtles and plankton, but pose little risk to mid-water or benthic (bottom dwelling) organisms. However, hydrocarbons dissolved or entrained into the water column, either upon release or through subsequent wind/wave action, will also affect other pelagic species and, if the spill reaches shallower areas, possibly also benthic organisms.

9.14.1.8.2 HFO

HFO is a dense, viscous oil with a low proportion of volatile aromatic hydrocarbons and high persistence in the marine environment. Unlike lighter oils such as condensate, the primary concern with HFO spills is the physical oiling (smothering) of marine organisms and habitats, rather than acute toxicity from dissolved hydrocarbons.

Due to its low volatility, HFO does not evaporate rapidly, resulting in slow weathering, meaning that large volumes of oil can remain on the surface or wash ashore, posing long-term risks to marine and coastal ecosystems. The limited evaporation also means that toxic components, while present, are less likely to disperse quickly into the atmosphere or water column.

HFO poses a potential exposure risk to surface-transiting species, including seabirds, marine mammals (such as cetaceans) and sea turtles. However, HFO poses little risk to receptors sub surface, as the high viscosity and density ensures oil stays on the surface. When HFO reaches coastal or shallow marine environments, oil can accumulate on shorelines and intertidal habitats.

9.14.1.8.3 MDO

MDO is a medium-weight distillate fuel that contains a moderate proportion of aromatic hydrocarbons and exhibits intermediate persistence in the marine environment. Compared to lighter oils like condensate, MDO is less volatile and more persistent, but less viscous and more biodegradable than heavier oils such as HFO.

Potential impacts to marine receptors in an open ocean environment from MDO spills involve both hydrocarbon toxicity and physical oiling, although the latter is less severe than with HFO. The toxicity is primarily associated with the aromatic hydrocarbon fraction, which can affect marine organisms through both surface exposure and water column contamination.

Offshore MDO poses a risk to surface transiting species, including seabirds, cetaceans and turtles, through both direct contact and toxicity. Compared to HFO, MDO is less likely to cause smothering, but it can still adhere to biological surfaces and impair physiological functions.

If MDO reaches coastal or shallow marine environments, it can impact intertidal zones, coral reefs, and seagrass beds, although its lower viscosity and higher biodegradability may reduce long-term persistence compared to HFO.

9.14.1.8.4 LOC Hazardous Liquids

Amines are water-soluble, reactive, and moderately toxic, with potential impacts primarily related to chemical toxicity rather than physical smothering like HFO.

In the event of a release into the marine environment, amines will rapidly dissolve into the water column due to their high solubility. This can lead to acute toxicity for marine organisms, particularly plankton, fish larvae, and other pelagic species. The toxicity is influenced by concentration and exposure duration. Amines do not persist long in the environment due to biodegradation and dilution, especially in open ocean conditions surrounding Prelude.

MEG is generally less toxic than amine, but still poses risks to marine ecosystems, particularly through oxygen depletion and nutrient imbalance. Upon release, MEG will dissolve quickly into the water column, with minimal surface persistence.

9.14.1.9 Oil Spill Modelling

To inform the evaluation of impacts and risks from a major spill, the trajectories and fates of hydrocarbons released from the worst-case credible scenarios detailed in Table 9-116 were investigated. Shell commissioned the RPS Group to undertake numerical oil spill and chemical fate modelling for all of the worst-case emergency events (RPS 2025b; RPS 2025d).

The oil spill modelling was carried out using a purpose-developed oil spill trajectory and fates model, SIMAP (Spill Impact Model Application Package). This model is designed to simulate the transport and weathering processes that affect the outcomes of hydrocarbon spills to the sea, accounting for the specific oil type, spill scenario, and prevailing wind and current patterns. Table 9-116 summarises the modelled parameters used for each scenario.

SIMAP is the evolution of the United States Environmental Protection Agency (US EPA) Natural Resource Damage Assessment model (French & Rines 1997; French 1998; French et al. 1999) and is designed to simulate the fate and effects of spilled oils and fuels for both the surface slick and the three-dimensional plume that is generated in the water column. SIMAP includes algorithms to account for both physical transport and weathering processes. The latter are important for accounting for the partitioning of the spilled mass over time between the water surface (surface slick), water column (entrained oil and dissolved compounds), atmosphere (evaporated compounds) and shoreline (stranded oil). The model also accounts for the interaction between weathering and transport processes. For hydrocarbons, the timeseries contour compilations include floating, entrained, dissolved and accumulated hydrocarbons.

To define trends and variations in the potential outcomes, a stochastic modelling process was followed, whereby SIMAP was applied to repeatedly simulate the defined spill scenarios using different samples of current and wind data selected randomly from historic time series data representative of the study area. Estimates of the net currents were derived by interpolating predictions of the drift currents using the Hybrid

Coordinate Ocean Model, created by the National Ocean Partnership Program, with estimates of the tidal currents at local space-scales generated by the three-dimensional hydrodynamic model HYDROMAP.

To account for the influence of the wind on surface-bound hydrocarbons, representative wind conditions were derived via wind speed and direction time series data sourced from the National Centre for Environmental Prediction Climate Forecast System Reanalysis database over the same temporal coverage as the current data (2010–2019, inclusive). Water temperature and Salinity are provided by NOAA and is a hindcast model of the climatological fields of in-situ temperature, salinity, and several additional variables (NOAA 2013).

For the hazardous liquids chemical spill modelling was undertaken using a three-dimensional chemical spill trajectory and weathering model, CHEMMAP (Chemical Mapping and Analysis Program), which is designed to simulate the transport, spreading, entrainment and decay of a unique chemical under the influence of changing meteorological and oceanographic forces. A stochastic modelling scheme was followed in this study, whereby CHEMMAP was applied to repeatedly simulate the defined spill scenarios using different samples of current and wind data. These data samples were selected randomly from an historic time series of wind and current data representative of the study area.

100 replicate simulations were completed for the scenarios using stochastic modelling with randomized currents to account for trends and variations in the prevailing forcing-conditions over the study region, which would affect the trajectory and weathering of spilled liquid. A Hybrid Coordinate Ocean Model (HYCOM) representing drift currents with atmospheric forcing and a hydrodynamic model (HYDROMAP) representing tidal forcing were used to simulate the spill scenarios. Further details on the modelled duration and replication are presented in Table 9-116.

Table 9-116: Summary of Modelled Hydrocarbon and Hazardous Liquids Scenarios

Scenario	Location	Location	Depth (m)	Hazardous Liquid	Duration	Total Volume (m^3)	Modelled Duration	Replication
Loss of Well Control (Prelude Condensate)	Prelude Production Well (P5)	Lat: 13°50"22" S Long: 123°19"35.8" E	237	Condensate	80 days	31,800	94 days	100 replicates per season. Summer, transitional, winter (300 total)
Vessel Collision (Prelude Condensate)	Prelude FLNG	Lat: 13°47.2´S Long: 123°19.0´ E.	surface	Condensate	2 hours	42,000	42 days	100 replicates per season. Summer, transitional, winter (300 total)
Vessel Collision (HFO)	Prelude FLNG	Lat: 13°47.2´S Long: 123°19.0´ E.	surface	HFO	1 hour	1,000	42 days	100 replicates per season. Summer, transitional, winter (300 total)
Vessel Collision (MDO)	Prelude FLNG	Lat: 13°47.2´S Long: 123°19.0´ E.	surface	Diesel	1 hour	750	21 days	100 replicates per season. Summer, transitional, winter (300 total)
LOC of Hazardous Liquids - Amine	Prelude FLNG	Lat: 13°47.2´S Long: 123°19.0´ E.	surface	Amine	1 hour	1,000	15 days	100 replicates (annualised)
LOC of Hazardous Liquids - MEG	Prelude FLNG	Lat: 13°47.2´S Long: 123°19.0´ E.	surface	MEG	1 hour	6,000	15 days	100 replicates (annualised)

9.14.1.10 Hydrocarbon Exposure Zones and Thresholds

The interaction of spilled hydrocarbons with environmental receptors can occur via different fates of oil presence in the marine environment, including floating, entrained, dissolved and shoreline accumulated oil.

Hydrocarbon exposure thresholds for each fate have been applied to the spill modelling and used to inform the assessment of potential impacts and risks. Table 9-117 describes the thresholds considered and how these are applied for the different fates of oil. The thresholds are aligned to the NOPSEMA Oil Spill modelling Guidance Bulletin (NOPSEMA 2019). The low, moderate and high exposure zones represent ranges of hydrocarbon concentrations, grouped on the basis of scientific knowledge of the potential impacts of the various hydrocarbon phases on environmental receptors (Table 9-117). The low exposure thresholds are used to delineate the Planning Area for oil spill response planning, bound the description of the environment (Section 7) and assess potential socioeconomic and cultural heritage impacts. The moderate and high exposure thresholds are defined as the adverse exposure zone within which environmental impact may occur in the event of a spill.

Table 9-117: Hydrocarbon Exposure Zones and Thresholds

Exposure Zone	Threshold	Justification
Floating		
Exposure Zone Low (1–10 g/m^2)	1 g/m^2	The 1 g/m^2 threshold represents the practical limit of observing hydrocarbon sheens in the marine environment and therefore was used to define the outer boundary of the low exposure zone. This threshold is considered below levels which would cause environmental harm and is more indicative of the areas perceived to be affected due to its visibility on the sea-surface. There is also the potential for waxy nodules (residue) to be visible within this low threshold due to the nature of Prelude Condensate as it undergoes weathering. This exposure zone represents the area contacted by the spill and defines the conservative outer boundary of the Planning Area from a hydrocarbon spill.
Adverse exposure zone Moderate (10–25 g/m^2)	10 g/m^2	An ecological impact threshold of 10 g/m² for floating oil has been identified, as this concentration has been observed to cause fatal effects on birds and other wildlife that interact with the water surface (French et al. 1996; French 2000).
Adverse exposure zone High (>25 g/m^2)	25 g/m^2	The 25 g/m^2 threshold is above the minimum threshold observed to cause ecological impact. Studies have indicated that a concentration of surface oil ≥25 g/m^2 would be harmful for the majority of birds that contact the hydrocarbon at this concentration (Koops et al. 2004; Scholten et al. 1996). Exposure above this threshold is used to define the high exposure zone.
Shoreline		
Exposure zone Low (10–100 g/m^2)	10g/m^2	A threshold of 10 g/m^2 has been defined as the zone of potential 'low' exposure. This exposure zone represents the area visibly contacted by the spill and defines the outer boundary of the Planning Area from a hydrocarbon spill.
Adverse exposure zone Moderate (100–1,000 g/m^2)	100g/m^2	French et al. (1996) and French-McCay (2009) have defined a shoreline oil exposure threshold of 100 g/m^2 for shorebirds and wildlife (furbearing aquatic mammals and marine reptiles) on or along the shore, which is based on studies for sublethal and lethal impacts. The 100 g/m^2 threshold has been used in previous environmental risk assessment studies (French et al. 2011;
Adverse exposure zone High (>1,000 g/m^2)	1,000g/m^2	

Exposure Zone	Threshold	Justification
		French-McCay 2004; French-McCay 2003; French-McCay et al. 2012; NOAA 2013). Thresholds of 100 g/m^2 and 1,000 g/m^2 will define the zones of potential 'moderate' and 'high' exposure on shorelines, respectively. Contact within these exposure zones may result in impacts to the marine environment and coastal areas. Modelling of zones that fall within these exposure thresholds is based on the loading predicted for the shoreline (10 g/m^2, 100 g/m^2 and 1,000 g/m^2).
Entrained		
Exposure zone Low exposure (10–100 ppb)	10 ppb	The 10 ppb threshold represents the lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC & ARMCANZ (2000) water quality guidelines. Due to the requirement for relatively long exposure times (>24 hours) for these concentrations to have an observable impact, they are only likely to affect juvenile fish, larvae and planktonic organisms that might be entrained (or otherwise moving) within the entrained oil plumes, or when entrained hydrocarbons adhere to organisms or entrained oil is trapped against a shoreline for periods of several days or more. This exposure zone is not considered to have the potential to result in significant biological impacts. This exposure zone represents the area contacted by the spill and conservatively defines the outer boundary of the Planning from a hydrocarbon spill.
Adverse exposure zone Moderate (100–500 ppb)	100 ppb	The 100 ppb threshold is considered conservative in terms of potential for toxic effects leading to mortality for sensitive mature individuals and early life stages of species. This threshold represents a potential zone of acute exposure, which is more meaningful over shorter exposure durations. The 100 ppb threshold was selected to define the moderate exposure zone. Contact within this exposure zone is likely to result in impacts to the marine environment.
Adverse exposure zone High (>500 ppb)	500 ppb	The 500 ppb threshold is considered a conservative high exposure level in terms of potential for toxic effects leading to mortality for more tolerant species or habitats. This threshold has been defined to indicate a potential zone of acute exposure, which is more meaningful over shorter exposure durations. The 500 ppb threshold has been selected to define the high exposure zone.
Dissolved		
Exposure zone Low (10–50 ppb)	10 ppb	Dissolved oil is the bioavailable fraction and thus key driver of toxicity, and potential ecological effect in the marine environment (French-McCay 2025). A concentration of 10 ppb dissolved oil is considered a low threshold at which ecological effects to sensitive life stages of sensitive species may occur (French-McCay 2025; Negri, Brinkman and Jones 2025) Exposure durations that inform this 10 ppb threshold were generally between 24 and 96 hours. Therefore, the use of 10 ppb dissolved instantaneous threshold (i.e. one hour modelling time step) is considered an unduly conservative low threshold for identifying where species regardless of sensitivity or life stage may be exposed to a

Exposure Zone	Threshold	Justification
		potentially harmful concentration. In addition, whilst some receptors such as corals may demonstrate impact at exposed to both high UV and dissolved oil at 1 ppb (French-McCay 2025), this is also based on extended exposure durations not instantaneous exposure. Therefore, 10 ppb dissolved instantaneous is considered an appropriate low threshold for all ecological receptors.
Adverse exposure zone Moderate (50–400 ppb)	50 ppb	A conservative threshold of 50 ppb was chosen as it is more likely to be indicative of potentially harmful exposure to fixed habitats over short exposure durations (French-McCay 2002). French-McCay (2002) indicates that an average 96-hour LC50 of 50 ppb could serve as an acute lethal threshold to 5% of biota. The 50 ppb threshold was selected to define the moderate exposure zone. Contact within this exposure zone is likely to result in impacts to the marine environment.
Adverse exposure zone High (>400 ppb)	400 ppb	A conservative threshold of greater 400 ppb was chosen as it is more likely to be indicative of potentially harmful exposure to fixed habitats over short exposure durations (French-McCay 2002). French-McCay (2002) indicates that an average 96-hour LC50 of 400 ppb could serve as an acute lethal threshold to 50% of biota. The 400 ppb threshold was selected to define the high exposure zone.

9.14.1.10.1 Chemical (Amine and MEG) Impact Thresholds

Amine

In the previous revision of the Prelude EP a moderate reliability threshold of 1.8 mg/L for amine was utilised. This value was derived by identifying previous studies with ecotoxicity results for marine organisms and using the ANZECC Guidelines to derive a threshold. This involved dividing the lowest LC50 value by a safety factor of 100. However, following the work undertaken by AIMS as part of the Adaptive Management Framework under the previous Prelude EP, the first ecological robust guideline value (GV) for amine was developed. The GV of 0.017 mg/L (PC99) was derived using robust SSDs from toxicity data on eleven tropical marine species following the most up to date Australian and New Zealand guidelines (Warne et al., 2025). This GV is approximately 100-fold lower than the previously applied 1.8 mg/L threshold.

MEG

MEG is classified as "practically non-toxic" to aquatic organisms by the U.S. Environmental Protection Agency (USEPA) and PLONOR under the OSPAR Commission. In the previous Prelude EP a Predicted No Effect Concentration (PNEC) of 859 mg/L, recommended by the World Health Organisation (WHO 2000), was used for assessing modelling outcomes. This MEG PNEC was derived from the No Observed Effect Concentration (NOEC) of 8,590 mg/L for chronic exposure of daphnids (reproductive end point assessment) divided by a safety factor of 10 (WHO 2000). However as for amine above, a site specific GV of 6.08 mg/L (PC 99) was derived for MEG by AIMS as part of the Adaptive Management Framework under the previous Prelude EP. This GV is considered to have high reliability based on the sample size (number of species tested and inclusion of at least four taxonomic groups), and based on adequacy of fit in the SSD (Species Sensitivity Distribution) analysis (ANZG, 2018).

9.14.1.11 Determination of Planning Area

The area that the stochastic modelling indicates may be exposed to any hydrocarbons above low exposure values has been combined for the worst-case scenarios detailed in Table 9-116 to determine the Planning Area (Figure 9-16). The planning area therefore encompasses all possible worst case modelled extents for the credible scenarios.

It is important to recognise that the stochastic modelling outputs represent the combined exposures of 300 separate spill simulations. The area affected by any one spill is much smaller. Figure 9-17 provides an example of the predicted exposure above the low exposure values for each of the hydrocarbon phases that would result from a single spill using deterministic modelling.

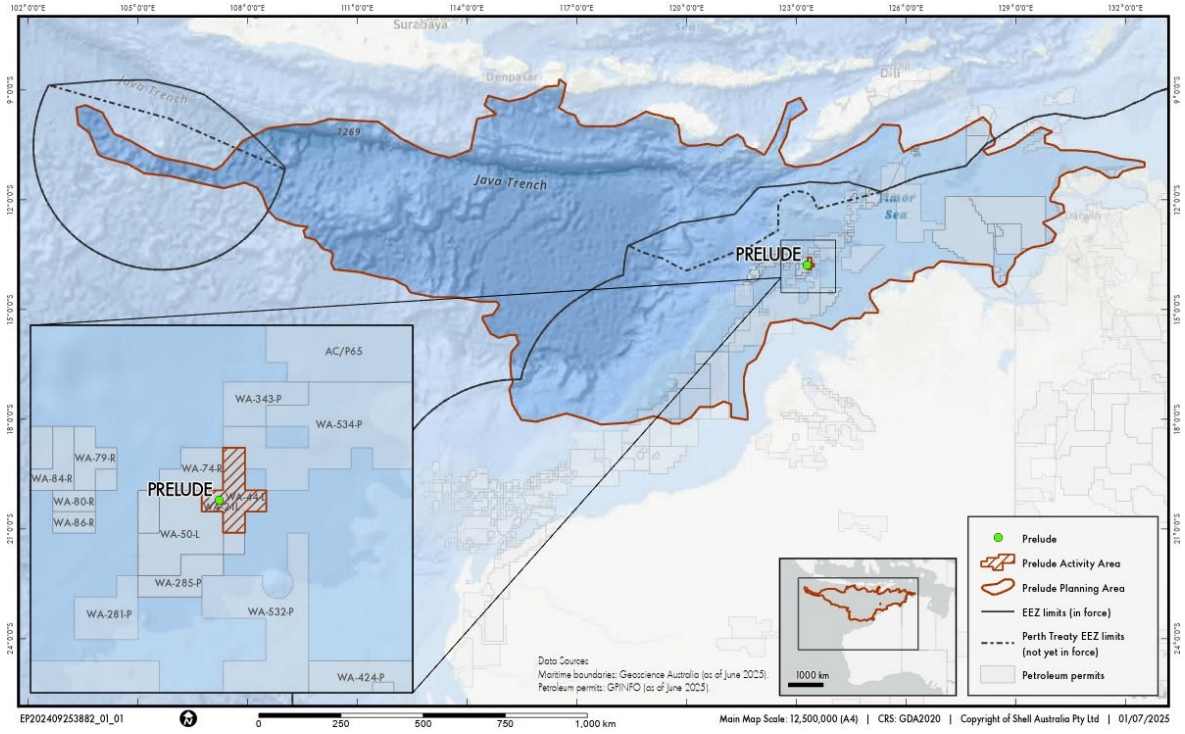


Figure 9-16: Annualised Maximum Extent (Planning Area) of Exposure Above Low Thresholds for Floating, Entrained, Dissolved and Shoreline Hydrocarbons for the combined Prelude worst case scenarios

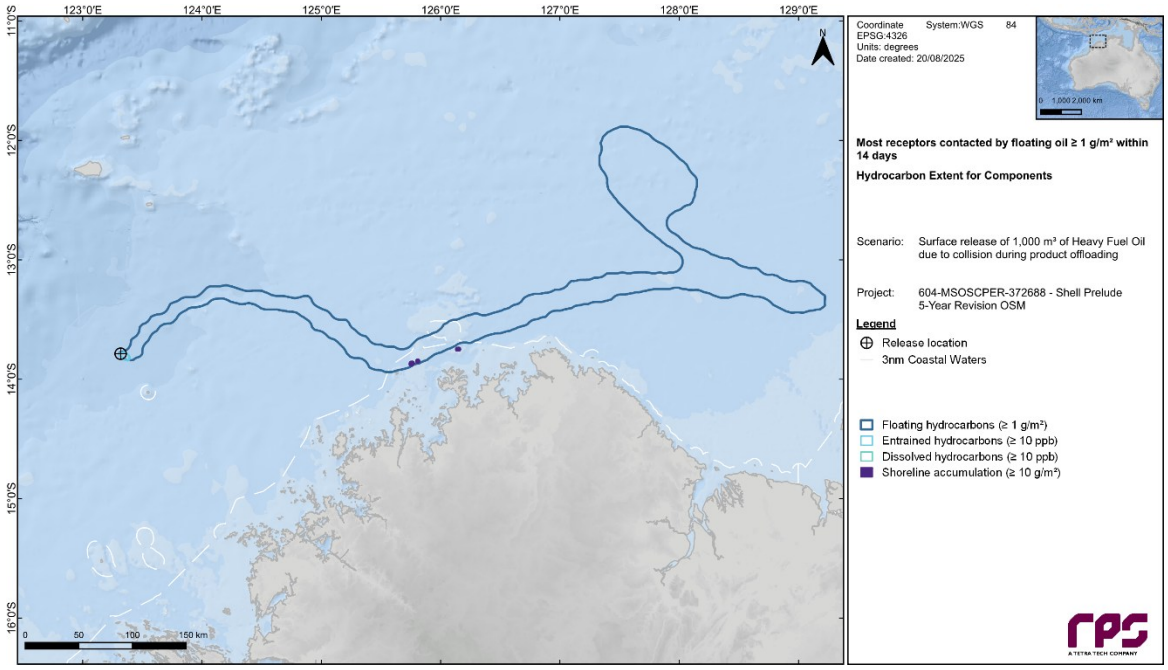


Figure 9-17: Extent of Exposure Above Low Thresholds for Floating, Entrained, Dissolved and Shoreline Hydrocarbons from a Single 1,000 m³ HFO Release (Deterministic Simulation)

9.14.1.12 Overview of Modelling Results

Table 9-118 lists the sensitive receptors that modelling indicates may potentially be exposed to hydrocarbons at concentrations at or above hydrocarbon adverse exposure values (floating 10 g/m^2, shoreline 100 g/m^2, entrained 100 ppb, dissolved 50 ppb) in Table 9-117. This table includes the chemical impact concentrations from Section 0. The extent of the exposure above adverse exposure thresholds for the worst case spill scenarios have been further described in Section 9.14.1.12 to determine the receptors at risk detailed in 9.14.1.14, which are risk assessed in Section 9.14.2. Shell considers all environmental receptors identified in the modelling as potentially (P>0.3%) being contacted. Given that the model comprises 300 simulation runs, a probability of 0.3% represents the lowest non-zero likelihood of contact that the model can produce corresponding to a single instance of contact occurring in one out of the 300 simulations. This will identify more receptors than would be impacted by a given release, and hence it is environmentally conservative. Full modelling results tables are found for each of the worst case scenarios in Appendix E.

Table 9-118: Summary of Hydrocarbon Spill Modelling Results for Sensitive Receptors that are Likely to be Contacted At or Above Adverse Exposure Thresholds (Floating 10 g/m^2, shoreline 100 g/m^2, entrained 100 ppb, dissolved 50 ppb)

Receptor Category	Hydrocarbon Phase Above Adverse Exposure Threshold				
	LOC from Subsea Infrastructure (Prelude Condensate)	Vessel Collision (MDO)	Vessel collision (HFO)	Vessel Collision (Prelude Condensate)	LOC of Hazardous Liquids (amine, MEG).
AMPs					
Argo-Rowley Terrace	-	-	✓	✓	-
Ashmore Reef	-	-	✓	✓	-
Cartier Island	-	-	✓	✓	-
Kimberley	-	✓	✓	✓	-
Oceanic Shoals	-	-	✓	✓	-
BIAs					
Dolphins	-	-	✓	-	-
Dugongs	-	-	✓	-	-
Marine Turtle	-	✓	✓	✓	✓
Seabirds	-	✓	✓	✓	-
Sharks	✓	✓	✓	✓	-
Whales	-	✓	✓	✓	-
Coastlines					
Augustus Island	-	-	✓	-	-
Bathurst Island	-	-	✓	-	-
Browse Island	-	✓	✓	✓	-
Bongaree island	-	-	✓	-	-
Champagny Island	-	-	✓	-	-

Receptor Category	Hydrocarbon Phase Above Adverse Exposure Threshold				
	LOC from Subsea Infrastructure (Prelude Condensate)	Vessel Collision (MDO)	Vessel collision (HFO)	Vessel Collision (Prelude Condensate)	LOC of Hazardous Liquids (amine, MEG).
Cobourg Peninsula	-	-	✓	-	-
Cartier Island	-	-	✓	✓	-
Cape Bougainville	-	-	✓	-	-
Cape Talbot	-	-	✓	-	-
Cassini Island	-	-	✓	-	-
Coronation Islands	-	-	✓	-	-
Cox-Finniss	-	-	✓	-	-
Croker Island	-	-	✓	-	-
D'Arcole Islands	-	-	✓	-	-
Forbin Island	-	-	✓	-	-
Indonesia	-	-	✓	-	-
Institut Islands	-	-	✓	-	-
Jingulu Island	-	-	✓	-	-
Jones Island	-	-	✓	-	-
Joseph Bonaparte Gulf Northern Territory	-	-	✓	-	-
Lafontaine Island	-	-	✓	-	-
Lamarck Island	-	-	✓	-	-
Lombok	-	-	✓	-	-
Maret Islands	-	-	✓	-	-
Melville island	-	-	✓	-	-
Mermaid Reef	-	-	-	-	-
Minjilang	-	-	✓	-	-
Niiwalarra Island	-	-	✓	-	-
Nusa Tenggara Barat	-	-	✓	-	-
Nusa Tenggara Timur	-	-	✓	-	-
Oxley Island	-	-	✓	-	-
Peron Islands	-	-	✓	-	-

Receptor Category	Hydrocarbon Phase Above Adverse Exposure Threshold				
	LOC from Subsea Infrastructure (Prelude Condensate)	Vessel Collision (MDO)	Vessel collision (HFO)	Vessel Collision (Prelude Condensate)	LOC of Hazardous Liquids (amine, MEG).
Pulau Danda/Sawa	-	-	✓	-	-
Sand Island	-	-	✓	-	-
Sumba Barat	-	-	✓	-	-
Sumba Timur	-	-	✓	-	-
Sumbawa	-	-	✓	-	-
Swift Bay	-	-	✓	-	-
Troughton Island	-	-	✓	-	-
West Montalivet Island	-	-	✓	-	-
West Arnhem	-	-	✓	-	-
White Island	-	-	✓	-	-
Exclusive Economic Zone					
Australian	✓	✓	✓	✓	✓
Indonesian	-	✓	✓	✓	-
East Timor	-	-	✓	-	-
Heritage Places					
Ashmore Reef National Nature Reserve	-	-	✓	✓	-
Scott Reef and surrounds	-	✓	✓	✓	-
Protected Wetlands					
Ashmore Reef	-	-	✓	✓	-
Cobourg Peninsula	-	-	✓	-	-
Marine Bio-Regions (IMCRA)					
Northwest Transition	-	-	✓	✓	-
Northwest Shelf Province	-	✓	✓	✓	-
Northwest Shelf Transition	-	-	✓	-	-
Timor Province	✓	✓	✓	✓	✓

Receptor Category	Hydrocarbon Phase Above Adverse Exposure Threshold				
	LOC from Subsea Infrastructure (Prelude Condensate)	Vessel Collision (MDO)	Vessel collision (HFO)	Vessel Collision (Prelude Condensate)	LOC of Hazardous Liquids (amine, MEG).
KEFs					
Ancient Coastline at 125 m Depth Contour	-	✓	✓	✓	-
Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	-	✓	✓	✓	-
Canyons linking the Argo Abyssal Plain with the Scott Plateau	-	-	✓	-	-
Carbonate Bank and Terrance System of the Sahul Shelf	-	-	✓	✓	-
Carbonate Bank and Terrace System of the Van Diemen Rise	-	-	✓	-	-
Continental Slope Demersal Fish Communities	✓	✓	✓	✓	✓
Pinnacles of the Bonaparte Basin	-	-	✓	-	-
Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	-	✓	✓	✓	-
Reefs, Shoals and Banks					
Ashmore Reef	-	-	✓	✓	-
Barracouta Shoal	-	-	✓	-	-
Baldwin Bank	-	-	✓	-	-
Branch Banks	-	-	✓	-	-
Deep Shoal	-	-	✓	-	-
Eugene McDermott Shoal	-	-	✓	✓	-

Receptor Category	Hydrocarbon Phase Above Adverse Exposure Threshold				
	LOC from Subsea Infrastructure (Prelude Condensate)	Vessel Collision (MDO)	Vessel collision (HFO)	Vessel Collision (Prelude Condensate)	LOC of Hazardous Liquids (amine, MEG).
Echuca Shoals	-	-	✓	✓	-
Favell Bank	-	-	✓	-	-
Flat Top Bank	-	-	✓	-	-
Goeree Shoal	-	-	✓	✓	-
Holothuria Reef	-	-	✓	-	-
Heywood Shoals	-	-	-	✓	-
Jabiru Shoals	-	-	✓	✓	-
Johnsons Bank	-	-	✓	✓	-
Long Reef	-	-	✓	-	-
Marie Shoal	-	-	✓	-	-
Mangola Shoal	-	-	-	✓	-
Mermaid Shoal	-	-	✓	-	-
Newby Shoal	-	-	✓	-	-
Otway Bank	-	-	✓	-	-
Penguin Shoal	-	-	✓	-	-
Robroy Reefs	-	-	✓	-	-
Sandy Islet	-	-	✓	✓	-
Seringapatam Reef	-	-	✓	✓	-
Scott Reef north	-	✓	✓	✓	-
Scott Reef South	-	✓	✓	✓	-
Sahul Bank	-	-	✓	✓	-
The Boxers Area	-	-	✓	-	-
Van Cloon Shoal	-	-	✓	-	-
Vulcan Shoal	-	-	✓	✓	-
Woodbine Bank	-	-	-	✓	-
West Holothuria Reef	-	-	✓	-	-
State Waters					
WA State Waters	-	✓	✓	✓	-
Northern Territory State Waters	-	-	✓	-	-

Receptor Category	Hydrocarbon Phase Above Adverse Exposure Threshold				
	LOC from Subsea Infrastructure (Prelude Condensate)	Vessel Collision (MDO)	Vessel collision (HFO)	Vessel Collision (Prelude Condensate)	LOC of Hazardous Liquids (amine, MEG).
Authorised Fishery Zones (Commonwealth–Managed Fisheries)					
North-West Slope Trawl	✓	✓	✓	✓	✓
Northern Prawn Fishery	-	-	✓	-	-
Southern Bluefin Tuna	✓	✓	✓	✓	✓
Timor Reef NT	-	-	✓	-	-
Western Skipjack (inactive)	✓	✓	✓	✓	✓
Western Tuna and Billfish	✓	✓	✓	✓	✓
Authorised Fishery Zones (WA–Managed Fisheries)					
Abalone	✓	✓	✓	-	-
Broome Prawn	✓	✓	✓	✓	✓
Kimberley Crab	✓	✓	✓	✓	✓
Kimberley Gillnet and Barramundi	-	-	✓	-	-
Kimberley Prawn	✓	✓	✓	-	-
Mackerel	✓	✓	✓	✓	✓
Northern Demersal Scalefish	✓	✓	✓	✓	✓
Pilbara Crab	-	-	✓	-	-
South West Coast Salmon	✓	✓	✓	✓	✓
Specimen Shell	✓	✓	✓	-	-
West Coast Deep Sea Crustacean	✓	✓	✓	✓	✓

(✓) Indicates contact predicted by modelling (P>0.3%) at this receptor at or above adverse exposure thresholds

(-) Indicates no contact predicted by modelling (P<0.3%) at this receptor at or above adverse exposure thresholds

9.14.1.12.1 Loss of Well Control – Prelude Condensate

The largest extent of hydrocarbon exposure for a LOWC of condensate is driven by the high wind simulations resulting in more entrained oil. The maximum modelled distance travelled at the low exposure value calculated from the release location is approximately 440 km towards the southwest during the transitional season. Whilst this is the worst-case LOC from subsea infrastructure, the modelled extent of this scenario fits within the

bounds of other worst case spill scenarios and does not contribute to the determination of the Planning Area described in Section 9.14.1.11.

The greatest extent for the hydrocarbons above the adverse threshold is shown in Figure 9-16, 177 km from the release location. No exposure to the Australian mainland coast was predicted under any of the scenario conditions.

Modelling showed that Prelude condensate would be prone to evaporation and biological decay. The mass balance forecast for the constant, low-wind case for Prelude condensate indicates that approximately 90.8% of the oil is predicted to evaporate within 12 hours after which the evaporation rate of the remaining oil is low. Under the stronger-wind case significant entrainment of Prelude condensate is indicated. 12 hours after the spill, 10.6% of the oil mass is forecast to have entrained and a further 88.2% is forecast to have evaporated, leaving only a small proportion of the oil floating on the water surface (<1%).

The increased level of entrainment in the stronger-wind case was also forecast to result in a higher proportion of the mixture breaking down due to biological and photochemical degradation. Decay rates of the order of 1.5% per day (~ 9.5% after 7 days) were calculated for the high wind case compared to a rate of ~ 0.25% per day (~1.7% after 7 days) in the low-wind case where the mixture remained as a surface-slick with lower exposure to microbes.

A loss of containment due to loss of well control based on discharge into ocean from the subsea wellhead through the 7” production tubing will involve the turbulent discharge of gas and condensate at the seabed through a restriction (7” production tubing). Where the release occurs at water depths exceeding 100-200 m, the gas plume would lose its momentum prior to breaking through to the surface and the entrained oil droplets may become trapped by the density layers in the water column (Chen & Yapa 2002).

The condensate will be discharged as a jet of small droplets into the water column (237 m below sea level) which would be carried forth and upwards to the sea surface by the buoyancy of the gas cloud, which will be counteracted by the viscous resistance imparted by the surrounding seawater. Thus, for a deep release such as this (>200 m), the gas and oil will tend to separate before the oil surfaces because the gas will either go into solution or accelerate away from the oil droplets. The height at which the gas lift ceases is referred to as the trapping height. The rate at which oil rises from the trapping height is determined by a number of factors, including the relative buoyancy of the oil versus local water density, the size of the droplets (increased viscous resistance for smaller sizes), the presence of density barriers in the water column and the action of shear currents that might be present in that location.

The Prelude modelling showed that the mixed plume was initially forecast to jet towards the water surface with a vertical velocity of around 5.2 m/s, gradually slowing and increasing in plume diameter as more ambient water is entrained. The model indicated that the plume would rise the full distance to the water surface, where the terminal velocity of the plume would be 3.6 m/s. The diameter of the entrained water plume at the surface was calculated at ~ 30 m.

Key modelled outcomes for each of the hydrocarbon fates above the adverse exposure thresholds are presented in Figure 9-16 and include:

- Management zones for several commercial fisheries (and for traditional Indonesian fishing) overlap the Activity Area and hence would be exposed to all phases of hydrocarbons in the event of a LOWC event.
- No **floating hydrocarbons** above the adverse exposure value of 10 g/m^2 are expected in any of the modelled simulations, therefore does not feature on Figure 9-16.
- No **accumulated shoreline** exposure above the adverse exposure value concentration of 100 g/m^2 is predicted in any of the modelled simulations, therefore does not feature on Figure 9-16. Maximum concentration at any one receptor is limited to 4 g/m^2 at Browse Island.
- **Entrained hydrocarbon** concentrations above 100 ppb were predicted to extend 26 km North from the release location. Modelling showed no probability of contact to shoreline receptors, BIA’s, or marine parks. One KEF for the Continental Slope Demersal Fish Communities showed predicted contact at low probability (6.3%).

- **Dissolved aromatic hydrocarbons** furthest extent for concentrations ≥50 ppb were 71 km in a Southwest direction during Transitional period. Modelling showed no probability of contact to shoreline receptors or marine parks. One BIA was contacted for sharks at very low probability (0.3%). One KEF for the Continental Slope Demersal Fish Communities showed predicted contact at low probability (1.6%)

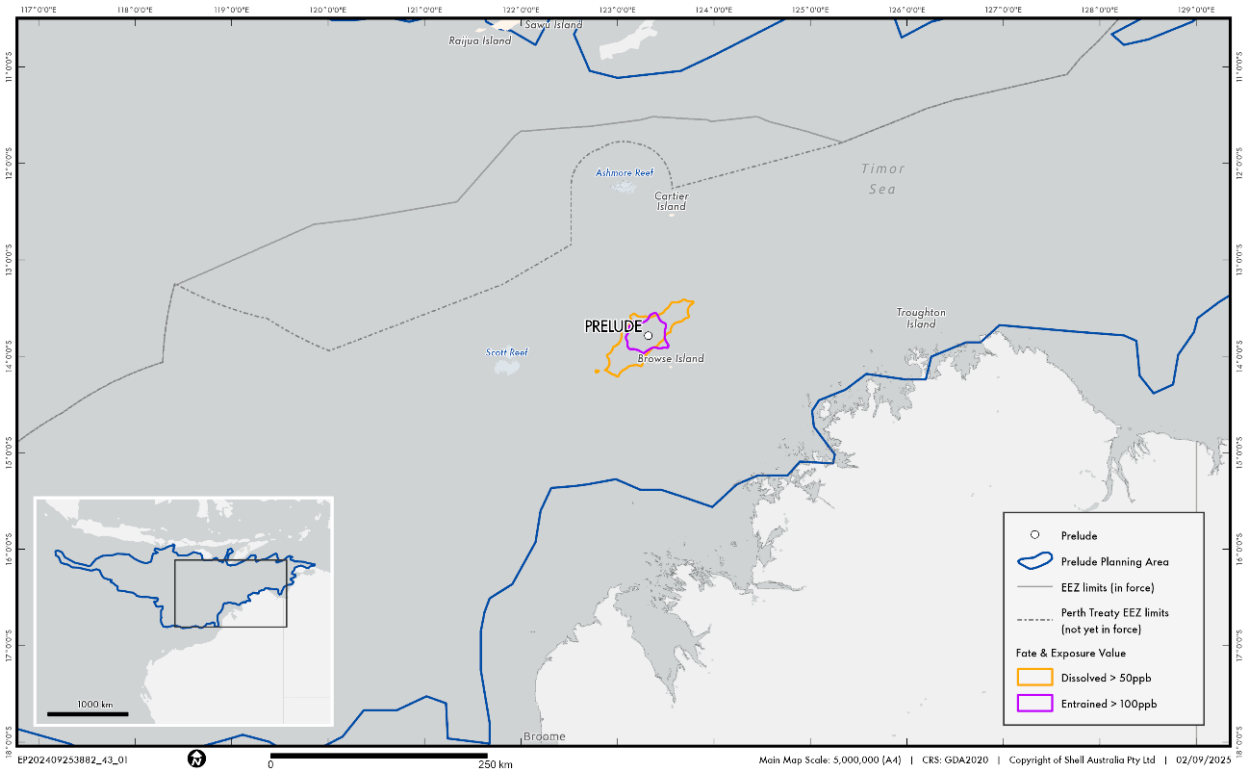


Figure 9-18: Annualised Maximum Extent Above Moderate Exposure Thresholds for Floating, Entrained, Dissolved and Shoreline Hydrocarbons for an 80-day LOWC Release of Prelude Condensate

9.14.1.12.2 Vessel Collision – MDO

The worst-case diesel spill modelling scenario included 1hr surface release of 750 m^3 of MDO. The largest modelled extent is contributed by entrained oil, indicating that MDO has a high probability of entraining into the water column under the high wind and sea conditions that occur at the release location. This outcome can be attributed to the low viscosity of the mixture as well as the high frequency of wind speeds that would generate sufficient wave energy to maintain entrainment. The maximum distance calculated from the release location at the low exposure values is 528 km West. Whilst this is the worst-case LOC of diesel from a vessel collision, the modelled extent of this scenario fits within the bounds of other worst case spill scenarios and does not attribute to the determination of the Planning Area described in Section 9.14.1.11.

The greatest extent for the hydrocarbons above the adverse threshold is shown in Figure 9-16, 306 km Northwest from the release location. No exposure to the Australian mainland coast was predicted under any of the scenario conditions.

Due to the volatility and low persistence of MDO, mass balance forecasts a high proportion of the product to evaporate over initial periods of the release (Section 9.14.1.7.3).

Key modelled outcomes for each of the hydrocarbon fate above the adverse exposure thresholds are presented in Figure 9-19 and include:

- Management zones for several commercial fisheries (and for traditional Indonesian fishing) overlap the Activity Area and hence would be exposed to all phases of hydrocarbons in the event of a vessel collision.

- **Floating hydrocarbon** concentrations above the adverse exposure value (10 g/m^2) extend up to 72 km to the west of the release location. Low probability of contact is predicted at Browse Island (0.3%) and BIAs for seabirds (0.3%) and sharks (0.3%).
- The highest maximum local **accumulated shoreline concentration** from the single worst case modelling run is predicted at the Browse Island receptor at 792 g/m² resulting in the accumulation of 25 m^3.
- **Entrained hydrocarbon** concentrations above 100 ppb were predicted to extend 306 km Northwest from the release location. Low probability of contact is predicted at Browse Island (1%), Scott Reef North (0.3%), Scott Reef South (0.3%) and BIAs for seabirds (0.3%), sharks (0.3%), marine turtles (0.6%) and whales (4.6%). The likelihood of entrained oil concentrations exceeding 100 ppb reaching the Indonesian EEZ is low (0.6%), with no projected contact with Indonesian coastlines. Several KEFs showed predicted contact at low probability, including Ancient Coastline (3%), Ashmore Reef and Cartier Island and surrounding Commonwealth Waters (0.3%), Continental Slope Demersal Fish Communities (19%), and Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex (0.3%).
- **Dissolved aromatic hydrocarbons** furthest extent for concentrations ≥50ppb was 19km North. Modelling showed no probability of contact to shoreline receptors, marine parks, KEFs or BIAs.

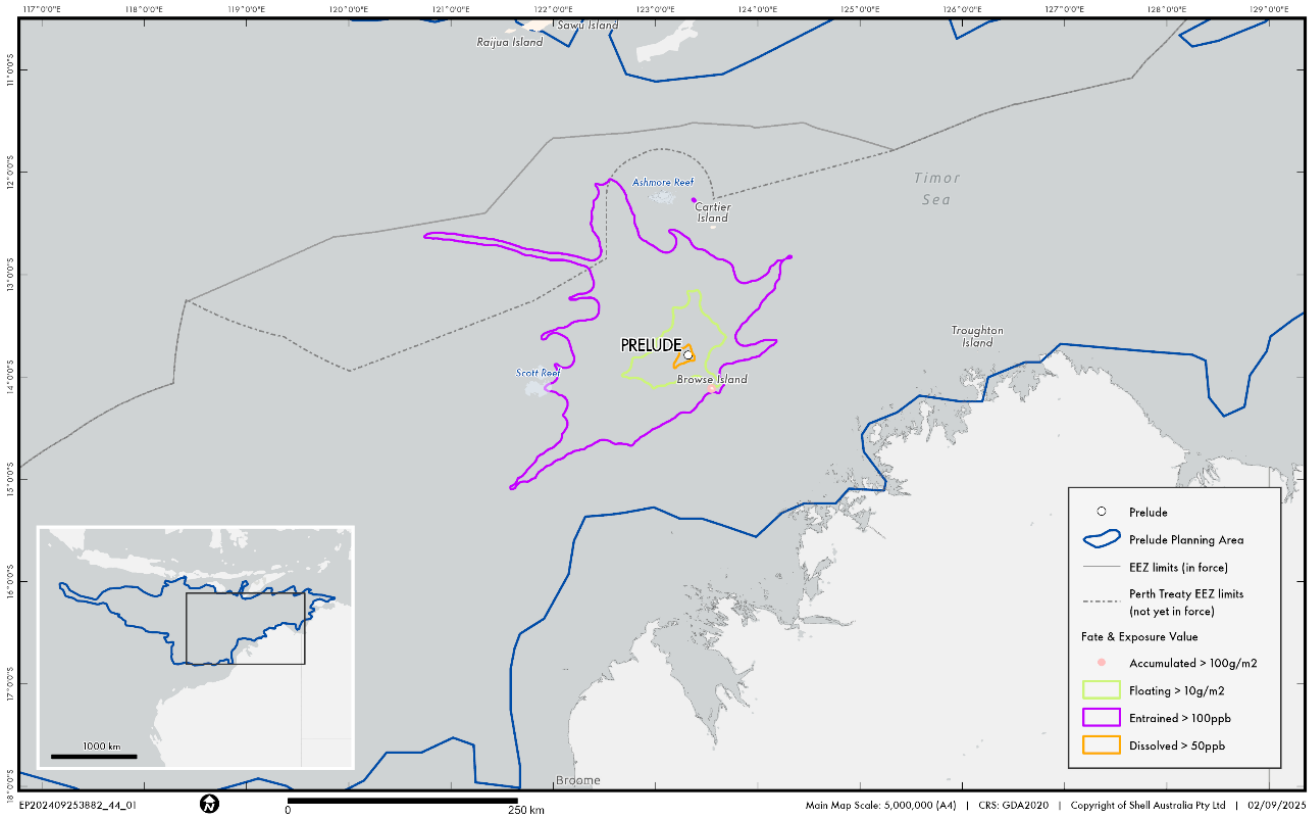


Figure 9-19: Annualised Maximum Extent Above Moderate Exposure Thresholds for Floating, Entrained, Dissolved and Shoreline Hydrocarbons for a 1 hour release of MDO from a vessel collision.

9.14.1.12.3 Vessel Collision - HFO

The worst-case HFO spill modelling scenario included a 1 hr surface 1,000 m^3 HFO spill event due to a tanker collision at the Prelude location. HFO contains a high proportion (73.1% by mass) of hydrocarbon compounds that will not evaporate at atmospheric temperature. These compounds will persist in the marine environment as residue until degraded by microbes and photo-chemical reactions, resulting in floating oil slicks expanding many kilometres from the release location.

The maximum modelled distance travelled at the low exposure value calculated from the release location is approximately 2,216 km towards the West during winter. The modelled extent of the HFO release contributes to the determination of the Planning Area described in Section 9.14.1.11.

The greatest extent for the hydrocarbons above the adverse threshold is shown in Figure 9-20, 1,040 km from the release location. Key modelled outcomes for each of the hydrocarbon fate above the adverse exposure thresholds are presented in Figure 9-20 and include:

- Management zones for several commercial fisheries (and for traditional Indonesian fishing) overlap the Activity Area and hence would be exposed to all phases of hydrocarbons in the event of a Vessel collision.
- The potential **floating oil** concentrations above the adverse exposure value (10 g/m^2) extend up to 1,040 km to the west of the release location, contacting a range of coastlines, BIA's, protected areas and KEFs. The probability of floating oil above adverse exposure values is predicted to enter the EEZ of Australia (100%), East Timor (0.3%) and Indonesia (3.3%). However, floating oil is not anticipated to contact East Timor or Indonesia coastline receptors above the adverse exposure value. Low probability of contact is predicted at Browse Island (2%), Scott Reef North (3.3%), Scott Reef South (3.3%), Seringapatam Reef (6%) and several other coastlines, reefs and shoals (see Table 9-119). Several AMPs show low probability of contact including Argo-Rowley Terrace (1%), Ashmore Reef (2.3%), Cartier Island (0.3%), Kimberley (1.6%) and Oceanic Shoals (1%). Predicted contact at several BIA's including Dolphins (0.6%), Marine Turtles (3.3%), Sharks (4.6%), Seabirds (4.6%) and whales (4.6%). The highest probability of contact at KEF's were 16.2% at the Continental Slope Demersal Fish Communities and 4% at the Ancient coastline 125 m Depth contour. Predicted contact at other KEFs at low probability (<2.5%) are presented in Table 9-119.
- **Shoreline accumulation** above the adverse exposure value (100 g/m^2) is predicted across multiple shoreline receptors in Australian Territory, including Browse Island (407 m^3), Scott Reef South (102 m^3), Maret Islands (720 m^3), Cape Bougainville (579 m^3) and several others (see Table 9-119, Appendix E, Appendix C). Maximum accumulated shoreline concentration within Australian territory is forecast at Maret Islands (10,170 g/m^2) and Browse Island (10,163 g/m^2). Whilst no floating oil above adverse thresholds is anticipated on Indonesian coastline, several receptors are contacted by accumulation above the adverse thresholds. This is likely due to the build-up of stranded shoreline oil from floating oil below the adverse floating oil threshold. Indonesian receptors show low probability of contact above the adverse accumulation threshold (Indonesia 1.3%, Lombok 0.3% and Sumba Barat 1.3%), with the maximum predicted volume of 512 m^3 at Indonesia.
- **Entrained hydrocarbon** concentrations above the adverse exposure value (100 ppb) were predicted to extend 71 km Southwest from the release location. Modelling showed no probability of contact to shoreline receptors, or marine parks. Two KEFs were contacted at low probability including Continental Slope Demersal Fish Communities (0.6%) and the Ancient Coastline at 125 m depth contour (0.3%). Low probability of contact at the Sharks BIA (0.3%).
- Plumes of **dissolved aromatic hydrocarbons** with concentrations of 50 ppb or greater were not forecast to occur within the model domain or within any of the assessed sensitive receptors, therefore does not feature on Figure 9-20.

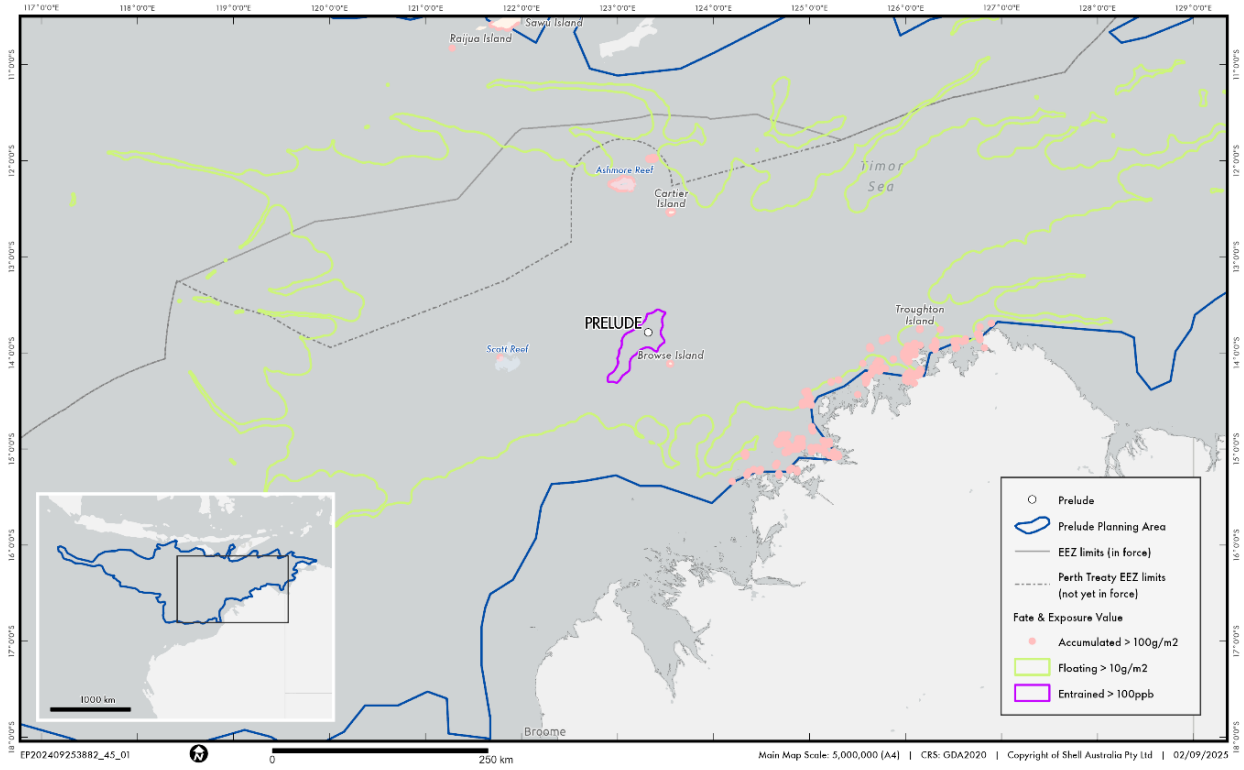


Figure 9-20: Annualised Maximum Extent Above Moderate Exposure Thresholds for Floating, Entrained, Dissolved and Shoreline Hydrocarbons for a 1 hour release of HFO from a vessel collision

9.14.1.12.4 Vessel Collision – Prelude Condensate

The worst-case modelled vessel collision scenario included 2 hr surface release of 42,000 m^3 of Prelude Condensate. Prelude condensate is a low viscosity hydrocarbon mixture with relatively low density when unweathered, which properties will result in rapid initial spreading at the water surface under calm sea conditions but susceptibility to wave-induced entrainment into the water column under more energetic sea conditions. The extent modelled is influenced by condensate entrainment resulting from high wind and sea states, causing oil to travel considerable distances subsea from the release point.

The maximum modelled distance travelled at the low exposure value calculated from the release location is approximately 1,378 km west. The modelled extent of this condensate release tracks further in a south westerly direction than the HFO release described in Section 9.14.1.12.3, and therefore contributes to the determination of the Planning Area described in Section 9.14.1.11.

The greatest extent for the hydrocarbons above the adverse threshold is shown in Figure 9-21, 551 km from the release location. Key modelled outcomes for each of the hydrocarbon fates above the adverse exposure thresholds are presented in Figure 9-21 and include:

- Management zones for several commercial fisheries (and for traditional Indonesian fishing) overlap the Activity Area and hence would be exposed to all phases of hydrocarbons in the event of a vessel collision.
- **Floating hydrocarbon** concentrations above the adverse exposure value (10 g/m^2) extend up to 123 km to the Southwest of the release location. No contact is expected at protected areas with low probability of contact predicted at shorelines, including Browse Island (0.3%) and BIAs for seabirds (0.3%), sharks (0.6%) and whales (1%). Continental Slope Demersal Fish Communities KEF shows a low probability of contact at 4.3%.
- The **maximum accumulated shoreline concentration** from the single worst case run is forecast at Browse Island is 1507 g/m^2 with the maximum accumulated shoreline volume being 50 m^3 at this receptor.

- **Entrained hydrocarbon** concentrations above 100 ppb were predicted to extend 561 km West from the release location. Contact is predicted to enter the EEZ of Australia (73.6%), and Indonesia (4.6%), however oil is not anticipated to contact Indonesia coastline receptors. Low probability of contact is predicted at Browse Island (5%), Scott Reef North (3%), Scott Reef South (2.6%) and Seringapatam Reef (4%). Contact is predicted at BIAs for seabirds (12.6%), whales (11.6%), sharks (10.3%) and marine turtles (2.6%). Contact at several protected areas is predicted at low probability, including Argo-Rowley Terrace (0.3%), Ashmore Reef (1.3%), Cartier Island (0.6%) and Kimberley (3%). Several KEFs showed predicted contact, including: Ancient Coastline (10%), Ashmore Reef and Cartier Island and surrounding Commonwealth Waters (1.3%), Carbonate Bank and Terrace System of the Sahul Shelf (0.3%), Continental Slope Demersal Fish Communities (30%) and Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex (4.3%).
- **Dissolved aromatic hydrocarbons** furthest extent for concentrations ≥50 ppb were 474 km in a South Westerly direction. Contact is predicted to enter the EEZ of Australia (61.3%), and Indonesia (1.6%), however oil is not anticipated to contact Indonesia coastline receptors. Low probability of contact is predicted at Browse Island (1.6%), Scott Reef North (0.3%), Scott Reef South (0.67%) and Seringapatam Reef (1%). Contact is predicted at BIAs for seabirds (4%), whales (4.3%), sharks (4%) and marine turtles (1%). Contact at several protected areas is predicted at low probability, including Argo-Rowley Terrace (0.3%), Ashmore Reef (0.3%), Cartier Island (0.3%) and Kimberley (1.3%). Several KEFs showed predicted contact, including Ancient Coastline (4%), Ashmore Reef and Cartier Island and surrounding Commonwealth Waters (0.6%), Continental Slope Demersal Fish Communities (18.6%) and Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex (1%).

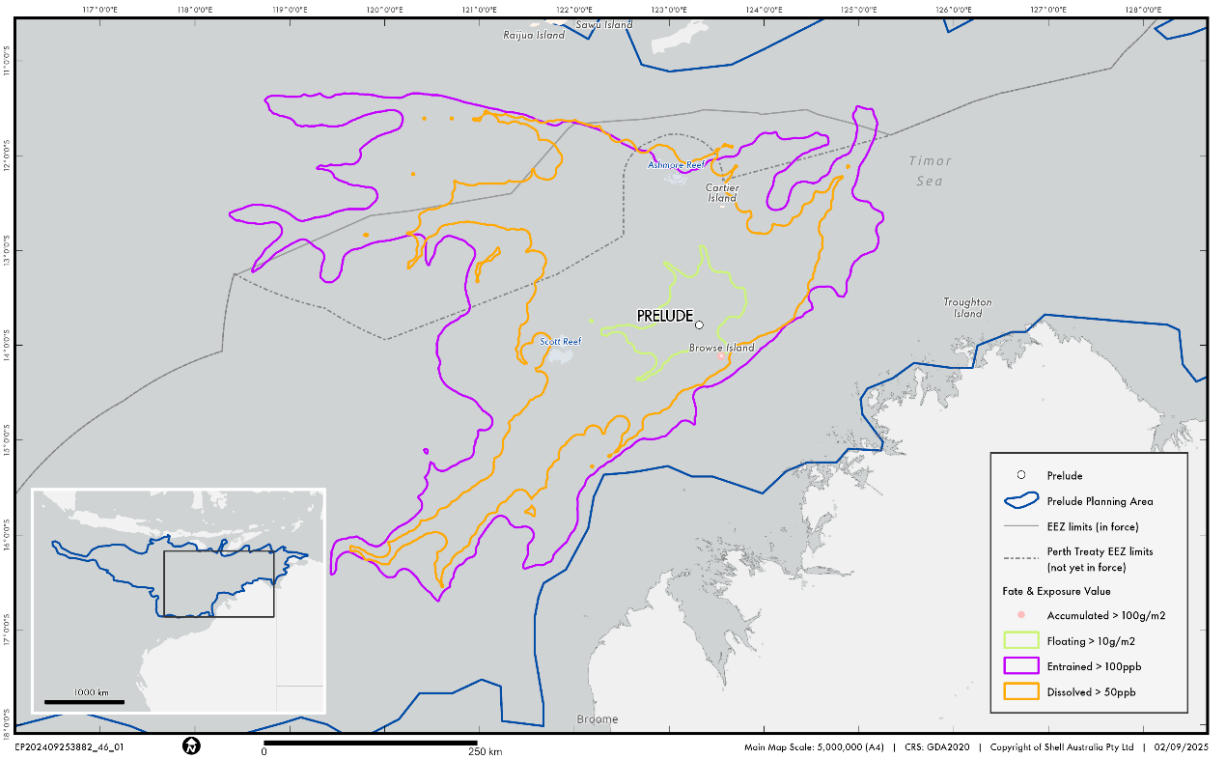


Figure 9-21: Annualised Maximum Extent Above Moderate Exposure Thresholds for Floating, Entrained, Dissolved and Shoreline Hydrocarbons for a 2 hour release of Condensate from a vessel collision

9.14.1.13 Hazardous Liquids

9.14.1.13.1 MEG

The CHEMMAP stochastic modelling study (RPS 2025d) for the 1 hour 6,000 m^3 MEG spill event during chemical loading operations shows dissolved MEG at or above 6 mg/L is forecast to potentially occur at

distances up to 21.4 km to the northeast and 21.5 km to the southwest of the release site across all modelled scenarios. Management zones for several commercial fisheries, as well as traditional Indonesian fishing, overlap the Activity Area and would therefore be exposed to dissolved MEG concentrations at or above 6 mg/L. Modelling indicates no other sensitive receptors would be contacted at the adverse impact threshold.

9.14.1.13.2 Amine Spill

The CHEMMAP stochastic modelling study (RPS 2025d) for the 1 hr surface 1,000 m^3 amine spill event predicts the 0.017 mg/L dissolved amine concentration to extend 39.9 km to the northeast and 37.1 km to the southwest of the release site across all modelled scenarios. Management zones for several commercial fisheries, as well as traditional Indonesian fishing, overlap the Activity Area and would therefore be exposed to amine above the adverse impact threshold. Low probability of dissolved amine at or above 0.017 mg/L is forecast to contact the Continental Slope Demersal Fish Communities KEF (7% probability at 17.8 km northwest, and max concentration 0.35 mg/L at 27 km north) and the Browse Island green turtle internesting habitat (1% probability at 22 km south-southwest, max concentration 0.05 mg/L). Given this KEF is located sub-surface in considerable water depth, contact is not expected given the positive buoyancy of the plume.

9.14.1.14 Determination of Receptors at Risk of Impact

Table 9-119 lists the sensitive receptors within the Planning Area that modelling indicates may potentially be exposed to hydrocarbon and chemical fates at concentrations at or above adverse exposure thresholds. Given two scenarios drive the worst case credible extent at the adverse exposure values (Vessel collision – HFO 9.14.1.12.3, Vessel Collision Prelude condensate 9.14.1.12.4), results from these scenarios have been used to populate the respective probabilities of exposure. Floating and shoreline modelled fates are derived from the Vessel collision – HFO modelling, Dissolved and entrained fates are derived from the Collision Prelude condensate. Full modelling tables are found in Appendix E.

Table 9-119: Receptors Predicted to be Exposed to Adverse Threshold for Hydrocarbon and Chemical Concentrations in a Worst-case Spill

Receptor	Probability of Exposure (%) at Adverse Threshold				Potential Exposure to Amine >0.017 mg/L	Potential Exposure to MEG >6 mg/L
	Floating	Shoreline	Entrained	Dissolved		
Australian Marine Parks						
Argo-Rowley Terrace	1[2]	-	0.3	0.3	No	No
Ashmore Reef	2.3	3.6	1.3	0.3	No	No
Cartier Island	0.3	1	0.6	0.3	No	No
Kimberley	1.6	-	3	1.3	No	No
Oceanic Shoals	1	-	2.3	0.6	No	No
BIAs						
Dolphins	0.6	1.6	-	-	No	No
Dugongs	-	3.6	-	-	No	No
Marine Turtle	3.3	7.6	2.6	1	Yes	No
Seabirds	4.6	7.6	12.6	4	No	No
Sharks	4.6	4.3	10.3	4	No	No
Whales	9.3	7.6	11.6	4.3	No	No
Coastlines						
Augustus Island	-	0.3	-	-	No	No
Bathurst Island	0.6	0.6	-	-	No	No
Browse Island	2	4.3	5	1.6	No	No
Bongaree island	-	0.3	-	-	No	No
Champagny Island	-	0.3	-	-	No	No

Receptor	Probability of Exposure (%) at Adverse Threshold				Potential Exposure to Amine >0.017 mg/L	Potential Exposure to MEG >6 mg/L
	Floating	Shoreline	Entrained	Dissolved		
Cobourg Peninsula	-	0.6	-	-	No	No
Cartier Island	-	1	0.3	-	No	No
Cape Bougainville	0.6	1.6	-	-	No	No
Cape Talbot	0.3	0.6	-	-	No	No
Cassini Island	0.3	1.6	-	-	No	No
Coronation Islands	0.3	0.6	-	-	No	No
Cox-Finniss	-	0.3	-	-	No	No
Croker Island	0.3	0.3	-	-	No	No
D'Arcole Islands	-	1.6	-	-	No	No
Forbin Island	-	1.3	-	-	No	No
Indonesia	-	1.3	-	-	No	No
Institut Islands	-	1.3	-	-	No	No
Jingulu Island	-	1	-	-	No	No
Jones Island	0.3	1	-	-	No	No
Joseph Bonaparte Gulf Northern Territory	-	0.3	-	-	No	No
Lafontaine Island	-	1	-	-	No	No
Lamarck Island	-	0.3	-	-	No	No
Lombok	-	0.3	-	-	No	No
Maret Islands	0.6	1.6	-	-	No	No
Melville island	0.3	0.6	-	-	No	No

Receptor	Probability of Exposure (%) at Adverse Threshold				Potential Exposure to Amine >0.017 mg/L	Potential Exposure to MEG >6 mg/L
	Floating	Shoreline	Entrained	Dissolved		
Minjilang	0.3	0.3	-	-	No	No
Niiwalarra Island	0.3	0.6	-	-	No	No
Nusa Tenggara Barat	-	0.3	-	-	No	No
Nusa Tenggara Timur	-	1.3	-	-	No	No
Oxley Island	-	0.3	-	-	No	No
Peron Islands	-	0.3	-	-	No	No
Pulau Danda/Sawa	-	0.6	-	-	No	No
Sand Island	0.6	1.6	-	-	No	No
Sumba Barat	-	-	-	-	No	No
Sumba Timur	-	0.6	-	-	No	No
Sumbawa	-	0.3	-	-	No	No
Swift Bay	-	0.6	-	-	No	No
Troughton Island	0.6	0.3	-	-	No	No
West Montalivet Island	0.3	0.3	-	-	No	No
West Arnhem	-	0.6	-	-	No	No
White Island	0.3	1	-	-	No	No
Exclusive Economic Zones						
Australian	100	-	73.6	61.3	No	No
Indonesia	3.3	-	4.6	1.6	No	No
East Timor	0.3	-	-	-	No	No

Receptor	Probability of Exposure (%) at Adverse Threshold				Potential Exposure to Amine >0.017 mg/L	Potential Exposure to MEG >6 mg/L
	Floating	Shoreline	Entrained	Dissolved		
Heritage Places						
Ashmore Reef National Nature Reserve	2.67	3.6	1.3	0.6	No	No
Scott Reef and surrounds	0.6	-	3	0.3	No	No
Protected Wetlands						
Ashmore Reef	2.6	-	1.3	0.6	No	No
Cobourg Peninsula	-	0.6	-	-	No	No
KEFs						
Ancient Coastline at 125 m Depth Contour	4.6[2]	-	10.3[1]	4[1]	No	
Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	2.3	3.6	1.3	0.6	No	No
Canyons linking the Argo Abyssal Plain with the Scott Plateau	0.6[2]	-	-	-	No	No
Carbonate Bank and Terrance System of the Sahul Shelf	1.3[2]	-	0.3[1]	-	No	No
Carbonate Bank and Terrace System of the Van Diemen Rise	0.6[2]	-	-	-	No	No
Continental Slope Demersal Fish Communities	16.6[2]	-	30[1]	18.6[1]	Yes	No
Pinnacles of the Bonaparte Basin	0.3[2]	-	-	-	No	No
Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	6	7.6	4.3	1	No	No
Reefs, Shoals and Banks						
Ashmore Reef	1.6	3.6	1.3	0.3	No	No

Receptor	Probability of Exposure (%) at Adverse Threshold				Potential Exposure to Amine >0.017 mg/L	Potential Exposure to MEG >6 mg/L
	Floating	Shoreline	Entrained	Dissolved		
Barracouta Shoal	0.3[2]	-	-	-	No	No
Baldwin Bank	0.3[2]	-	-	-	No	No
Branch Banks	0.6[2]	-	-	-	No	No
Deep Shaol	0.3[2]	-	-	-	No	No
Eugene McDermott Shoal	0.6[2]	-	1	0.3	No	No
Echuca Shoal	4[2]	-	0.6	0.3	No	No
Favell Bank	0.6[2]	-	-	-	No	No
Flat Top Bank	0.3[2]	-	-	-	No	No
Goeree Shoal	1[2]	-	2.3[1]	0.6[1]	No	No
Holothuria Reef	0.6[2]	-		-	No	No
Heywood Shoals	1.6[2]	-	0.6[1]	0.3[1]	No	No
Jabiru Shoals	0.3[2]	-	0.3[1]	-	No	No
Johnsons Bank	1.6[2]	-	1[1]	0.3[1]	No	No
Long Reef	0.6[2]	-	-	-	No	No
Marie Shoal	0.3[2]	-	-	-	No	No
Mangola Shoal	-	-	0.3[1]	-	No	No
Mermaid Shoal	0.3[2]	-	-	-	No	No
Newby Shoal	0.3[2]	-	-	-	No	No
Otway Bank	0.6[2]	-	-	-	No	No
Penguin Shoal	0.3[2]	-	-	-	No	No

Receptor	Probability of Exposure (%) at Adverse Threshold				Potential Exposure to Amine >0.017 mg/L	Potential Exposure to MEG >6 mg/L
	Floating	Shoreline	Entrained	Dissolved		
Robroy Reefs	0.3[2]	-	-	-	No	No
Sandy Islet	2	7.6	1.3	0.3	No	No
Seringapatam Reef	6[2]	-	4	1	No	No
Scott Reef north	3.6	-	3	0.3	No	No
Scott Reef South	3.3	7.6	3	0.6	No	No
Sahul Bank	1[2]	-	0.3[1]	-	No	No
The Boxers Area	0.6[2]	-	-	-	No	No
Van Cloon Shoal	0.6[2]	-	-	-	No	No
Vulcan Shoal	1[2]	-	1.6	0.3	No	No
Woodbine Bank	-	-	1[1]	0.3[1]	No	No
West Holothuria Reef	0.3[2]	-	-	-	No	No
State Waters						
WA State Waters	3.3	-	4	1.6	No	No
Northern Territory State Waters	0.6	-	-	-	No	No
Authorised Fishery Zones (Commonwealth-managed Fisheries)						
North-West Slope Trawl	100	-	73.6	61.3	Yes	Yes
Northern Prawn Fishery	0.6	0.6	-	-	No	No
Southern Bluefin Tuna	100	7.6	73.6	61.3	Yes	Yes
Timor Reef NT	0.3	-	-	-	No	No
Western Skipjack (inactive)	100	7.6	73.6	61.3	Yes	Yes

Receptor	Probability of Exposure (%) at Adverse Threshold				Potential Exposure to Amine >0.017 mg/L	Potential Exposure to MEG >6 mg/L
	Floating	Shoreline	Entrained	Dissolved		
Western Tuna and Billfish	100	7.6	73.6	61.3	Yes	Yes
Authorised Fishery Zones (WA-managed Fisheries)						
Abalone	5.3	-	14	7.6	No	No
Broome Prawn	5.3	-	14	-	No	No
Kimberley Crab	100	-	73.6	61.3	Yes	Yes
Kimberley Gillnet and Barramundi	0.6	-	-	-	No	No
Kimberley Prawn	4.6	-	4	2.3	No	No
Mackerel	100	-	73.6	61.3	Yes	Yes
Northern Demersal Scalefish	100	-	73.6	61.3	Yes	Yes
Pilbara Crab	1	-	0.3	0.3	No	No
South West Coast Salmon	100	-	73.6	61.7	Yes	Yes
Specimen Shell	5.3	-	14	7.6	No	No
West Coast Deep Sea Crustacean	100	-	73.6	61.3	Yes	Yes

(-) Indicates no contact predicted by modelling (P<0.3%) at this receptor at or above adverse impact thresholds

[1] Indicates contact at or above adverse impact thresholds at depth of this receptor not confirmed by modelling

[2] Indicates modelling shows floating hydrocarbons pass over but will not contact submerged receptor

9.14.2 Description and Evaluation of Impacts and Risks

Table 9-120 indicates the environmental features and values and sensitivities that have been identified to be potentially affected by a worst-case spill scenario during the Activities covered by this EP, with further evaluation to each potentially affected receptor category provided in Sections 9.14.2.1 to 9.14.2.7. Features or values and sensitivities which are not credibly affected are not discussed further.

Table 9-120 Emergency Events Receptor Impact Screening Summary

	Protected Areas			Features																	Values and Sensitivities																				
				Physical		Natural				Socioeconomic								Heritage and Cultural			Physical				Natural							Socioeconomic							Heritage and Cultural		
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect																																									

Legend:		
		Potentially affected
	×	Predicted impact

9.14.2.1 Protected Areas

9.14.2.1.1 Marine Conservation Reserves

Modelling indicates that several marine parks would potentially be contacted by floating, accumulated entrained and dissolved hydrocarbons above the adverse exposure values (Table 9-119). Ashmore and Cartier marine parks would potentially be exposed to HFO floating oil at low probability (2.3% and 0.3% respectively) with shoreline accumulation predicted (3.6% and 1% respectively), resulting predicted maximum accumulation of 8 m^3. Floating oil from a HFO release is also predicted at Kimberley (1.6%) and Oceanic Shoals (1%) AMPs but no accumulation above the adverse threshold is expected. Low probability for entrained and dissolved contact from a condensate release is predicted at Argo-Rowley Terrace (0.3%), Ashmore (1.3%), Cartier (0.6%), Kimberley (3%) and Oceanic Shoals AMPs (2.3%).

No predicted impact to AMPs is predicted from worst case hazardous liquids above adverse thresholds.

Marine parks support increased productivity or abundance of marine fauna that use the waters – including plankton, pelagic invertebrates and fish, marine mammals, marine reptiles and seabirds – which may be impacted by hydrocarbons; these are further risk assessed in Section 9.14.2.5.6. The main risks of impact to natural values of a marine park from spills are those from the HFO release. As HFO weathers or gets mixed with sand or sediment, it may become dense enough to sink, resulting in some localised smothering of benthic subsea or intertidal habitats. The minimum time to accumulation of hydrocarbons at AMPs above the adverse exposure threshold is >177 hours suggesting the HFO will be weathered exposing contact locations to potential smothering.

Stochastic modelling showed that in-water (entrained, dissolved) hydrocarbons were predicted to remain within <50 m of the sea surface. Therefore, exposure receptors in deeper waters are not predicted to occur. However, impacts to benthic habitat communities may occur in shallow waters of the AMPs. Given the minimum time to contact for any fate at the adverse exposure value is relatively long (>177 hours), the magnitude of impacts to the environmental values of these marine parks are likely to be limited.

9.14.2.1.2 Wetlands of International and National Significance

Ashmore Reef, Cobourg Peninsula and Mermaid Reef are the only wetlands of international (Ramsar) or national importance within the Planning Area (Section 7.3.1.4).

Modelling shows predicted contact above adverse thresholds at Ashmore Reef and Coburg Peninsula. Contact at Ashmore reef is limited to low probabilities of contact of HFO floating oil (2.6%) and condensate entrained and dissolved oil (1.3% and 0.6% respectively). No shoreline accumulation is expected at Ashmore above adverse thresholds. Contact at the Cobourg Peninsula is limited to accumulated oil from the HFO release at a low probability of contact (0.6%).

No predicted impact to wetlands of international (Ramsar) or national importance from worst case hazardous liquids above adverse thresholds.

Ashmore Reef and Coburg Peninsula are located ~139 km and 937 km from Prelude and the modelling indicates that there would be an extended period until exposure above the adverse exposure values (Ashmore Reef 173 hours, Coburg Peninsula 905 hours). Migratory bird species associated with Ashmore reef Ramsar site are particularly vulnerable to floating and entrained oil and any resulting accumulations of oil along shorelines. The Cobourg peninsula includes a diverse array of wetland types, such as intertidal mudflats, extensive mangrove forests, freshwater swamps, coastal lagoons, and estuarine systems which would be impacted by accumulated oil. Given the time to contact for the condensate release, the residues arriving at the RAMSAR sites would be substantially weathered, reducing the magnitude of impacts. The minimum time to accumulation of hydrocarbons at RAMSAR wetlands above the adverse exposure threshold is >177 hours suggesting the HFO will be weathered, exposing contact locations to potential smothering. The impacts to oiling to migratory birds are further described in Section 9.14.2.5.6.

9.14.2.1.3 Commonwealth and National Heritage Places

Ashmore Reef National Nature Reserve and Scott Reef Surrounds are the only Commonwealth Heritage Places predicted to be exposed to oil above adverse exposure thresholds in the event of a worst-case spill.

Low probability of contact for all hydrocarbon phases is predicted at Ashmore Reef (floating 2.6%, accumulation 3.6%, entrained 1.3% and dissolved 0.6%). Worst-case maximum accumulation of hydrocarbons above the adverse exposure value are estimated at 804 m^3 from the HFO release. The maximum concentration of entrained and dissolved oil from in the unlikely event of exposure were relatively low (199 ppb and 89 ppb respectively).

The probability of contact at Scott Reef Surrounds was low and limited to floating (0.6%), dissolved (3%) and entrained (0.3%), with no predicted accumulation above the adverse exposure value.

No predicted impact to Commonwealth Heritage Places from worst case hazardous liquids above adverse thresholds.

Scott Reef Surrounds and Ashmore Reef National Nature Reserve's heritage values relate to its natural features (see Section 1.3.1.5), including breeding and foraging habitat for marine turtles, high diversity of marine fauna, and a small population of dugong (DCCEEW 20023ae) as well as providing an important staging and feeding area for many migratory shorebirds (Environment Australia 2002). Potential impacts to these natural features and values are discussed under the relevant sections below.

The residual risk to protected areas is ranked Yellow (Consequence: Major, Likelihood: B-Remote) (see Table 9-121).

9.14.2.2 Physical Features

9.14.2.2.1 Marine Regions

The Planning Area is situated within NMR and NWMR (Section 7.4.1). The NMR comprises Commonwealth waters from west Cape York Peninsula to the Northern Territory–WA border. The Planning Area overlaps this region eastward as far as the Timor Seas and Croker Island, some of Arafura seas but not the Gulf of Carpentaria or waters off the Queensland coast. The NWMR region extends along the WA-NT border down to Kalbarri, Western Australia, encompassing an area of ~1,067,731 km^2. The region is characterised by shallow-water tropical marine ecosystems and is home to globally significant populations of internationally threatened species.

The key physical features of the NMR and NWMR (Section 7.4.1) that may be affected by hydrocarbons or hazardous liquids are generally associated with the seafloor and, apart from shallow reefs/shoals/banks (assessed in Sections 9.14.2.5.3 and 9.14.2.5.4), are at depths that preclude significant exposure to the surface and near-surface (<50 m depth) hydrocarbon plumes that would result from a worst-case spill scenario during the Activity.

The residual risk to physical features is ranked Dark Blue (Consequence: Minor, Likelihood: B-Remote) (see Table 9-121).

9.14.2.3 Physical Values and Sensitivities

9.14.2.3.1 Air Quality

The environment around the Prelude FLNG is largely free of industrial air pollution with the main sources of pollutants being commercial shipping, other (e.g. fishing) vessels and oil and gas industry activities located nearby (see Section 7.5.1). In the event of a worst-case spill there would likely be a localised, temporary impact to air quality within the area affected. This would include the temporary gas plume from a release of Prelude production fluids and the evaporation into the atmosphere of the volatile hydrocarbons within a surface slick. This is likely to result in reduced air quality at and above the ocean surface which could pose a risk to air breathing fauna that remained within the area affected, as well as a human health and safety risk. Significant adverse effects on air quality are likely to be restricted to the immediate vicinity of the release, with a gas plume and/or evaporated hydrocarbons expected to disperse rapidly in the open, offshore environment of the Activity Area.

Given the localised and temporary nature of impacts on air quality and the rapid recovery to ambient quality once the source of impact ceased, the consequences for air quality in the Activity Area and/or surrounding region are considered to be limited.

9.14.2.3.2 Water Quality

A worst-case spill of oil would affect water quality within the resulting plume, notably through the dispersion and dissolution of hydrocarbons into the water column as well as the introduction of other constituents of the oil, including metals. The physical presence of the surface slick may also cause changes in water quality indirectly, such as through reduction in light penetration and oxygen levels, and/or as a result of subsequent changes in biotic activity, such as increased microbial activity associated with biodegradation of the oil. Given the nature of the oils that might be released during an emergency event, the greatest potential for adverse changes to water quality, in intensity, spatial extent and environmental implications, relates to hydrocarbons.

Light oils such as Prelude condensate have a high proportion of aromatic hydrocarbon compounds (e.g. BTEX, naphthalenes) which are highly volatile, evaporating rapidly on release to the sea surface but also dissolving readily either at the surface or following entrainment of fresh oil into the water column (see hydrocarbon characteristics in Section 9.14.1.7.1). This process would be ongoing for the duration of the release in the immediate vicinity of the release location. The modelling indicates that in the event of a worst-case LOWC release, maximum dissolved hydrocarbon concentrations could exceed the ANZG 80% species protection DGV for the soluble aromatic hydrocarbon benzene of 1300 ppb. These concentrations would reduce with depth and with distance from the release point, with the modelling indicating concentrations of dissolved hydrocarbons >50 ppb would be limited to surface waters <20 m depth and would fall below 50 ppb (comparable to the 99% species DGV for naphthalene) beyond ~10 m water depth in the area within ~50 km of the spill site.

There is no specific ANZG DGV for entrained oil, however the modelling results indicate entrained concentrations in the water column would reduce to below the designated adverse exposure thresholds within 561 km of the worst case release under all conditions modelled.

The dissolved hydrocarbon fraction will have the greatest impact on water quality due to the presence of compounds such as BTEX and PAHs, which are known to be toxic to marine biota. BTEX compounds are not expected to persist in the marine environment due to their volatility and will continually diminish due to weathering and biodegradation once released into the environment. PAHs are less volatile than BTEX due to their higher molecular weight/more complex structures and are expected to persist for longer. The concentrations of hydrocarbons in the water column will decrease over time once the release has stopped due to processes such as dispersion, dilution, physical and biological degradation, and evaporation.

For short duration worst case release scenarios (i.e. diesel, HFO and condensate), these processes will begin to reduce the total amount of hydrocarbons in the water column shortly after the release. MEG and amine spills may also adversely affect water quality to an extent. The MEG concentration of 6 mg/L was modelled to be contained within a 21.5 km distance from the release location. MEG is readily biodegradable and its concentration will reduce significantly within days of the release. Refer to Section 9.9.3.2.1 for further impact assessment on MEG in the marine environment. Amine will affect a larger area than a MEG spill with an impact threshold of 0.017 mg/L, which is forecast to extend over 35.3 km to the north and east, and 37.1 km to the southwest under all modelled scenarios. The product readily exhibits biodegradability and is not anticipated to bioaccumulate and therefore is not persistent in the marine environment (Nalco Champion n.d).

9.14.2.3.3 Sediment Quality (Seabed)

Regional sediment quality is not expected to be significantly affected by any of the worst-case scenarios. Elevated levels of water column hydrocarbons (e.g. BTEX, PAHs) that may occur in the vicinity of a surface release are unlikely to reach the seabed due to the water depth at the release location and low natural sedimentation rates in the region. Prelude's worst-case releases may contaminate sediments by advective transport of the plume that will be formed during the release (Romero et al. 2015). This is considered likely to occur for the loss of well containment scenario due to the relatively long duration of the release. Any resulting contamination will be concentrated around and down-current from the wellhead. Adversely, modelling shows that entrained and dissolved hydrocarbons from the LOWC scenario above adverse exposure thresholds are limited to <30 m water depth throughout the duration of the release. Modelling of worst-case scenarios indicates that hydrocarbons reached a maximum depth of 50 metres during the simulation period of a surface release of condensate from a vessel collision, insufficient to make contact with the seabed in an open water environment.

Due to the low density and volatile nature of the hydrocarbon, weathered condensate is unlikely to be deposited to the seabed. The diesel and HFO releases from a loss of fuel from a vessel scenario have relatively low portions of volatiles, which are expected to evaporate quickly following the release. The remaining diesel and HFO fractions may sink to the seabed if exposed to considerable sedimentary particles, however this is considered very unlikely to occur in the open sea due to the low density of the residual hydrocarbons relative to seawater and the naturally low suspended solids and associated sedimentation rates. Residual diesel and heavy fuel oils near shorelines may be exposed to higher sediment loads and be more likely to sink. Stranding of residual/persistent oils on shorelines may lead to long-term contamination of sediments with high-molecular weight hydrocarbons. These compounds are typically much less toxic than low-molecular weight hydrocarbons. Modelling indicates accumulation of HFO above the adverse exposure value (100 g/m^2) is predicted across multiple shoreline receptors in Australian Territory, including Browse Island (407 m^3), Scott Reef South (102 m^3), Maret Islands (720 m^3), Cape Bougainville (579 m^3) and several other locations (see Table 9-119).

The surface releases of amine and MEG are not considered likely to affect sediment quality due to the low inherent natural suspended solids, low sedimentation rates and the properties of the amine and MEG constituents, which are reported to have low organic carbon-water partition coefficient, KOC, indicating low adhesion/ high mobility of those hazardous liquids in sediments (NLM Toxnet Database). Additionally, the amine plume will be buoyant due to lower density relative to seawater so it will remain in the surface layers of the water column.

The residual risk to physical values and sensitivities is ranked Yellow (Consequence: Major, Likelihood: B Remote) (see Table 9-121).

9.14.2.4 Natural Features

9.14.2.4.1 Marine Bioregions

Marine bioregions (see Section 9.14.2.2.1) that fall within the area of the adverse exposure values for Prelude's worst case Emergency Events include:

- Northwest Shelf Province Bioregion
- Northwest Shelf Transition Bioregion
- Northwest Transition Bioregion
- Timor Province Bioregion.

The likely impacts of a worst-case spill on the features within these bioregions that are potentially susceptible to adverse effects from hydrocarbons are detailed below.

Benthic and Demersal Communities

Benthic and demersal communities would be buffered from the potential effects of surface hydrocarbons by the water column above them. Modelling of worst-case scenarios indicates that hydrocarbons above the adverse exposure value reached a maximum depth of 50 m during the simulation period of a surface release of condensate from a vessel collision, insufficient to make contact with the seabed in an open water environment.

Seabed releases of Prelude well fluids might expose benthic and/or demersal communities adjacent and immediately down current of the release location to oil droplets in the gas and condensate plume, but this is expected to be highly localised and for a short duration. The seabed in the Activity Area and surrounds is characterised by bare sediments which host low density infaunal and epibenthic communities of filter feeding and deposit feeding organisms. These fauna species may be subject to acute and chronic toxic effects from exposure to hydrocarbons, however the extent of the affected habitat is expected to be localised to the vicinity of the release location. This bare sediment habitat is widely represented in the Timor Sea, and the associated fauna assemblages are not considered to be particularly sensitive or of high conservation value. Filter feeding benthic communities may be vulnerable to entrained and dissolved hydrocarbons. Entrained hydrocarbons can be ingested by filter feeders, leading to increased exposure due to accumulation of ingested oil droplets (Payne & Driskell 2003).

While typically less toxic than dissolved hydrocarbons, entrained oil may still cause toxic effects and may also result in physical impacts such as clogging of filter feeding organs, potentially resulting in reduced feeding efficiency. Filter feeder, and sessile organisms in general, may be exposed to concentrations of dissolved hydrocarbons that result in acute and chronic toxic effects. The more diverse benthic communities in the adverse exposure zone are found in shallower waters (<50 m depth) or in association with islands, shoals, reefs, banks and the shoreline of the Australian, Indonesian and Timor-Leste mainlands. This diversity is due to ambient conditions supporting a healthy presence of primary producers, such as zooxanthellate corals, macroalgae and seagrasses and mangroves.

Modelling results from the condensate, diesel and HFO scenarios indicate that several offshore reefs and islands, banks and shoals, may be contacted by hydrocarbons above adverse impact thresholds. Contact at shallow waters associated with shoals and banks are discussed in Section 9.14.2.5.3, and reefs and islands in Section 9.14.2.5.4.

Modelling indicates the Continental Slope Demersal Fish Communities KEF is within the zone of the adverse exposure values for floating, entrained and dissolved oil. Given the nature of the worst-case releases, hydrocarbons are predicted to remain in the top 50 m of the water column. The minimum depth of the continental slope demersal fish KEF is 220 m, therefore, extensive contact with the demersal fish species of the KEFs is not anticipated. KEFs are risk assessed in Section 9.14.2.5.5.

Given their high biodegradability, MEG or amine spills will have transient effects on water quality and as such are not expected to adversely affect benthic or demersal communities.

Many benthic fauna species (e.g. corals, echinoderms, sponges) have planktonic larval phases. Organisms with planktonic larval phases typically produce very high numbers of larvae. A worst-case credible spill may result in increased mortality of planktonic larvae in the water column (which are subject to high natural mortality); however, this is not expected to result in population-scale impacts.

Pelagic Communities

Pelagic communities in the Planning Area for a worst-case spill scenario include planktonic communities and pelagic fish and invertebrates. EPBC Act listed species of fish (including sharks and rays) are discussed in Section 9.14.2.5.6.

Within the waters of the bioregions potentially affected by a worst-case spill scenario there are a range of phytoplankton and zooplankton. Direct contact with hydrocarbons, particularly the aromatic compounds present in unweathered condensate, has the potential to cause short-term acute toxic effects to these organisms. Planktonic communities are characterised by relatively rapid turnover rates of short-lived biota. The high turnover rate will lead to rapid recovery as the spilled hydrocarbons decay in the environment as a result of weathering and biodegradation processes. Within plankton communities, there is evidence from laboratory studies that some taxonomic groups, particularly zooplankton (e.g. copepods) may be more sensitive to hydrocarbon pollution (Almeda et al. 2013; Jiang et al. 2010). Ichthyoplankton, including that associated with Southern Bluefin Tuna spawning, may also be more susceptible to impacts (see below) although the proportion of the Southern Bluefin Tuna spawning ground potentially exposed to adverse concentrations of hydrocarbons is very low. Few reliable studies have shown any impacts of hydrocarbon spills on planktonic communities, with most studies concluding that impacts from hydrocarbon pollution cannot be distinguished from natural variability (Abbriano et al. 2011; Davenport et al. 1982; Varela et al. 2006).

The concentrations of toxic hydrocarbons in the water column will decrease with time and distance from release due to processes such as dispersion, dilution, physical and biological degradation, and evaporation. For short duration release scenarios (e.g. diesel, condensate, HFO from a vessel collision), these processes will begin to reduce the total amount of hydrocarbons in the water column shortly after the release, limiting the duration of potential effects on pelagic communities. The worst-case LOWC will continue to release fresh hydrocarbons into the waters surrounding the facility for the duration of the release, but these will be subject to rapid evaporation and degradation such that elevated concentrations, particularly of aromatic components, are unlikely to be persistent at any location further away.

Stochastic modelling results indicate that hydrocarbons are likely to be concentrated in surface waters of <50 m depth. As a result, demersal fish are unlikely to be directly affected unless near a subsea release and pelagic fish are more likely to encounter dissolved and entrained hydrocarbons above adverse exposure thresholds.

Modelling indicates maximum distance for entrained and dissolved fates above the adverse exposure value extent 551 km from the release location. Fish respire through gills, which makes them more vulnerable to dissolved hydrocarbons than air-breathing fauna, such as cetaceans, marine reptiles and birds. Despite this apparent vulnerability, significant fish mortalities are rarely observed to occur because of hydrocarbon spills (Fodrie and Heck 2011; International Tanker Owners Pollution Federation 2011b), although instances of fish mortality from spills in confined areas (e.g. bays) have been recorded. These observations may be consistent with fish moving away from hydrocarbons in the water (Hjermann et al. 2007).

Exposure of fish to hydrocarbons may result in acute and chronic effects which would vary depending on a range of factors such as exposure duration and concentration, life history stage, inter-species differences and other environmental stressors (Westera and Babcock 2016). Environmental monitoring of pelagic and demersal fishes immediately following the Montara oil spill indicated that fish were exposed to hydrocarbons, although no adverse effects were detected (Gagnon and Rawson 2012, 2011). Further sampling and testing over time indicated that fish captured in close proximity to the Montara wellhead were comparable to those collected from reference sites (Gagnon and Rawson 2012, 2011).

Most marine fish species produce very high numbers of eggs, which then undergo a planktonic larval development phase. Early life history stages of fish (planktonic eggs and larvae) may be more vulnerable to hydrocarbon pollution than juvenile and adults, as these early life history phases cannot actively avoid water with high concentrations of hydrocarbons. Fish embryos and larvae may exhibit genetic and developmental abnormalities from long-term exposure to low concentrations of hydrocarbons (Fodrie and Heck 2011), although such long exposures may not be representative of real-world conditions. PAHs have also been linked to increased mortality and stunted growth rates of early life history (pre-settlement) of reef fishes, as well as behavioural impacts that may increase predation of post-settlement larvae (Johansen et al. 2017). Given the temporal and spatial scale of the worst-case credible spill scenarios, and the typically high supply of eggs and larvae, it is unlikely that any of the worst-case credible spill scenarios will result in significantly reduced recruitment of fish due to impacts during early life history phases. This conclusion is supported by studies of fish stocks following large-scale hydrocarbon spills, which have shown relatively little evidence of reduced recruitment at the scale of fish stocks/populations (Fodrie and Heck 2011).

Given their high biodegradability, MEG or amine spills will have transient effects on water quality and as such are not expected to adversely affect local fish communities at the population level.

The residual risk to natural features is ranked Dark Blue (Consequence: Minor, Likelihood: B-Remote) (see Table 9-121).

9.14.2.5 Natural Values and Sensitivities

9.14.2.5.1 BIAs

No identified BIAs overlap the Activity Area, however, modelling for the Prelude worst-case scenarios indicate a low to moderate probability that BIAs outside the Activity Area may be exposed to hydrocarbon concentrations above adverse impact thresholds for HFO and condensate, including BIAs for:

- Dolphins (<2% probability for floating and shoreline exposure)
- Dugongs (1.6% probability for shoreline exposure)
- Marine turtles (7.6% probability for shoreline, <5% for floating, entrained and dissolved exposure)
- Seabirds (12.6% probability for entrained, 7.6% shoreline, <5% floating and dissolved exposure)
- Sharks (10.3% probability for entrained, <5% floating, shoreline and dissolved exposure)
- Whales (11.6% probability for entrained, 9.3% floating, 7.6% shoreline and 4.3% dissolved exposure).

BIAs for turtles fall within the extent of the adverse exposure zone for amine. In contrast, no BIAs are located within the adverse exposure zone for MEG.

The BIAs likely to be impacted by the Prelude worst case spill scenarios are discussed under the relevant species-specific sections below.

9.14.2.5.2 Critical Habitats

There are no critical habitats listed on the Register of Critical Habitats within the Planning Area. However, the recovery plan for marine turtles (CoA 2017b) identifies areas considered to represent critical habitat for internesting activity in green turtles habitat critical for survival and therefore are risk assessed. Nesting locations where Internesting activity for green turtles within the adverse exposure values for Prelude worst case scenarios include Ashmore and Cartier Reef, Scott Reef and Browse Island. Section 9.14.2.5.6 describes the potential impacts from oil exposure in marine turtles.

9.14.2.5.3 Shoals and Banks

The Timor Sea region contains numerous named shoals and banks, including over 21 that fall within the Planning Area, many of which are subsea receptors and will have no impact from floating oil. The modelling indicates that 22 shoals and banks might be exposed to entrained or dissolved hydrocarbons above adverse exposure thresholds in the event of a worst-case spill event (Table 9-119). Only 5 shoals and banks (Eugene McDermott Shoal, Goeree Shoal, Johnsons Bank, Vulcan Shoal and Woodbine Bank) have more than a 1% probability of being contacted above adverse exposure values. Stochastic modelling results indicate that hydrocarbons are likely to be concentrated in surface waters of <50 m depth, precluding contact at many of the deep water shoals and banks with predicted contact. No exposure above high impact thresholds for entrained or dissolved oil from a condensate release was predicted, and minimum times to contact at these shoals were greater than 195 hours, suggesting hydrocarbons would be weathered reducing the potential for toxicity effects.

No predicted contact at shoals or banks at the adverse exposure threshold are anticipated for hazardous liquids.

Studies of the shoals and banks in the region show these features host biological communities distinct from the surrounding, relatively deep, bare sediment habitat (e.g. Heyward et al. 2017, 2012, 1997). The banks were found to be hosting a range of light-dependent ecosystems characterised by benthic primary producers, such as coral and macroalgae. Surveys of shoals near the Prelude FLNG following the Montara oil spill indicated these communities did not exhibit obvious impacts as a result of the spill (Heyward et al. 2013, 2012, 2010). However, considerable natural variation both over time and between locations was observed (Heyward et al. 2013). Reviews of the ecological function of the shoals and banks in the Timor Sea east of the Activity Area concluded there is a relatively high degree of connectivity between shoals and banks, with the banks acting as a series of ‘stepping stones’ (Heyward et al. 2017, 2013). In the event of a disturbance to benthic communities as the result of a hydrocarbon spill, the upstream shoals and banks may act as a source of propagules or larvae, which could enhance recovery.

Contact with dissolved and entrained hydrocarbons above adverse exposure thresholds may result in mortality of benthic biota. Corals and, to a lesser extent seagrasses and macroalgae, are susceptible to acute and chronic impacts from exposure to entrained or dissolved hydrocarbons (Shigenaka 2001;. The loss of habitat-forming biota such as corals, macroalgae or sponges at shoals and banks could result in changes to habitats, with consequent changes to associated fauna assemblages.

The time required for recovery following any disturbance due to hydrocarbon exposure will depend on the nature and scale of the impact. Although predicted to exceed adverse threshold concentrations, the maximum entrained and dissolved concentrations at all shoals and banks within the adverse exposure zone identified by modelling, are below the ANZG 99% species protection DGV for benzene (maximum of 628 ppb at Gorree Shoal). Shoals and banks in the region have been exposed to significant intermittent disturbance for long periods of time, such as damage from cyclones and changes in water temperature associated with the El Niño-Southern Oscillation. Differences in benthic communities over time within and between shoals and banks (such as those observed by Heyward et al. 2013) may represent different phases of ecological succession.

9.14.2.5.4 Offshore Reefs and Islands

A total of 8 reefs and 25 islands are predicted to potentially be exposed to adverse threshold concentrations of hydrocarbons in the event of Prelude worst-case scenario (Table 9-119). Only Browse Island, Ashmore Reef, Scott Reef South and Seringapatam reef showed over a 5% probability of being contacted above adverse exposure values, with remaining reefs and islands predicting <2% probability of contact, including Cartier island and Scott Reef North.

No predicted contact at offshore reefs and islands at the adverse exposure threshold are anticipated for hazardous liquids.

Browse Island and surrounding waters sit within WA State Territorial Waters, with the island itself consisting of sand and limestone situated on a foundation of coral reef (Shell 2009). The island is an important breeding ground for green turtles (Chelonia mydas) and for nesting seabirds whilst the reef is home to soft and hard corals. These reefs and islands host a range of biological communities that are distinct from coastal islands and the mainland. Like the shoals and banks described in Section 9.14.2.5.3, offshore reefs and islands typically host light-dependent ecosystems characterised by benthic primary producers.

Ashmore Reef is characterised as a scleractinian coral reef. Ashmore Reef falls under the protection of a National Marine Park and is also designated a Ramsar wetland of international significance (Section 7.3.1.4), consisting of a large platform reef complex with lagoons and large areas of drying flats that are exposed at low tide. Cartier Island and surrounding reefs are protected by the Cartier Island Marine Park, with the island comprising unvegetated sand on a large platform rising from the seabed

Scott and Seringapatam reefs are also scleractinian coral reefs and are regionally important for their high biodiversity. They represent the limit of the geographic range of many fish species, including Indonesian species that are not found anywhere else in Australia. In addition, the reefs are the only known habitat in WA for many sea snakes, including the dusky sea snake, fish, molluscs and echinoderms. Scott Reef also supports a small but genetically distinct breeding population of green turtles and is an important staging post for migratory shorebirds. It is also thought to be a foraging area for seabirds, including roseate terns, lesser frigatebirds, brown boobies and wedge-tailed shearwaters (Donovan et al. 2008).

Oil spill modelling predicted that of these reefs and islands, Scott Reef South has the highest likelihood of exposure above adverse impact thresholds for hydrocarbons, with a 7.6% chance of oil accumulating on shoreline, 3.3% probability of floating contact, 3% probability of entrained contact and 0.6% probability of dissolved contact. The potential impacts to submerged receptors associated with offshore reefs and islands will be similar to those for shoals and banks (Section 9.14.2.5.3). The minimum predicted time to exposure to shoreline oil at any island is 28 hours at Browse Island from HFO, indicating oil may be moderately weathered prior to contact. Given the persistent nature of HFO, shoreline oil may potentially accumulate above the adverse exposure value at Browse Island (407 m^3), Scott Reef South (102 m^3) and Ashmore Reef (804 m^3). Any accumulated hydrocarbons interacting with these shorelines is likely to represent the persistent fraction in the form of viscous liquid and as tar balls. Accumulated HFO that becomes stranded on coastlines are likely to remain for extended periods and become buried in the sediments. The long-term persistence of the hydrocarbons on sandy beaches will depend on the wave exposure and concentrations within sediments. Fernandez-Fernande et al. (2016) studied the long-term persistence of HFO in sandy beaches on the coast of Spain. The study recorded low concentrations of HFO buried within the sand as tar balls or oil coatings (last step of physiochemical degradation) seven years after the spill.

Stranding of oil on emergent islands and reefs may result in a band of weathered oil between the low and high-water marks on shorelines and intertidal corals. This may also result in impacts to fauna using these habitats, such as nesting turtles and wading birds (impacts described in Section 9.14.2.5.6).

9.14.2.5.5 KEFs

Modelling results for worst case scenarios indicated several KEFs will be exposed to adverse impact thresholds for floating, entrained, dissolved and shoreline oil for condensate and HFO (Table 9-119). KEFs that may experience contact above adverse exposure thresholds include (see Table 9-119):

- Ancient coastline at 125 m depth contour
- Ashmore Reef and Cartier Islands and surrounding Commonwealth waters
- Canyons linking the Argo Abyssal Plain with the Scott Plateau
- Carbonate Bank and Terrance System of the Sahul Shelf
- Carbonate Bank and Terrace System of the Van Diemen Rise
- Continental slope demersal fish communities
- Pinnacles of the Bonaparte Basin

- Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex.

A spill of amine may drift over the Continental Slope Demersal Fish Communities KEF, however given this receptor is located sub-surface in considerable water depth, this is unlikely to lead to any environmental effects or damage given the expected positive buoyancy of the plume.

All KEFs except Ashmore Reef and Cartier Islands and surrounding Commonwealth waters and Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex are entirely sub-tidal. Given the maximum depth of dissolved and entrained hydrocarbons from Prelude worst case release will remain in the top 50 m, it is unlikely that these receptors would be exposed to oil above the adverse exposure value.

The continental slope demersal fish communities and ancient coastline at 125 m depth contour are the closest KEF to the release point (17 km and 36 km respectively), therefore would have a higher probability of contact from entrained and dissolved oil from a subsea LOWC. The relatively diverse benthic communities associated with these habitats, such as filter feeding communities and demersal fish assemblages may be impacted by dissolved and entrained hydrocarbon above adverse exposure thresholds, which may result in acute or chronic toxic effects. Modelling indicates the Continental Slope Demersal Fish Communities KEF is within the zone of the adverse exposure values for floating, entrained and dissolved oil. Given the nature of the worst-case releases, hydrocarbons are predicted to remain in the top 50 m of the water column. The minimum depth of the continental slope demersal fish KEF is 220 m, therefore, extensive contact with the demersal fish species of the KEFs is not anticipated.

Several offshore reefs and islands within KEFs were identified by the modelling study results as potentially being contacted by hydrocarbons above adverse exposure thresholds. These include Ashmore Reef and Cartier Island and Seringapatam Reef and Commonwealth waters in the Scott Reef complex. Modelling shows potential for floating oil contact (Ashmore 2.3%, Seringapatam 6%) and accumulation above the adverse exposure values (Ashmore 3.6%, Seringapatam 7.6%). Modelling also shows contact above the adverse exposure value for entrained (Ashmore 1.3%, Seringapatam 4.3%) and dissolved oil (Ashmore 0.6%, Seringapatam 1%). These offshore reefs and islands typically host light-dependent ecosystems characterised by benthic primary producers and biological communities that are distinct from coastal islands and the mainland. Potential impacts to the submerged and coastline receptors associated with these KEFs is risk assessed in the offshore reefs and islands in Section 9.14.2.5.4.

9.14.2.5.6 Threatened, Migratory, Marine and Cetacean Species

Marine Mammals

A range of marine mammals may occur within the planning area, as described in detail in Section 7.7.10.

The modelling indicates that there is a low probability of entrained (11.6%) and dissolved (4.3%) oil above adverse threshold levels reaching the blue whale migration BIA. This BIA is ~78 km from the Prelude location and the modelling indicates an extended period (>76 hours) after release until contact, suggesting any exposure would involve moderately weathered hydrocarbons. Worst-case maximum exposure concentrations for dissolved and entrained oil from a condensate release are predicted to be 8, 167 ppb (entrained). Low probability of floating (1.6%) oil from a HFO release is predicted at the Australian Humpback Dolphin BIA on the Kimberley coast.

Cetaceans exposed to hydrocarbons may exhibit avoidance behaviour. Geraci and St Aubin (1988) documented apparent avoidance of floating hydrocarbons by bottlenose dolphins, suggesting that at least some cetaceans exhibit the ability to detect and avoid surface slicks. However, observations from spill events have noted whales and dolphins travelling through and feeding in oil slicks. The Deepwater Horizon spill in the Gulf of Mexico saw observers sighting cetaceans regularly swimming in surface slicks offshore (and nearshore) (Aichinger Dias et al. 2017). Cetaceans were also observed during the spill response for the Montara oil spill, these included false killer whales, bottlenose dolphins, spotted dolphins, and spinner dolphins (Watson et al. 2009).

Cetaceans exposed to dissolved, entrained or surface hydrocarbons may suffer external oiling, potential ingestion of oil and inhalation of toxic vapours, especially if close to the release location (Deepwater Horizon Natural Resource Damage Assessment Trustees 2016). Impacts from direct exposure are expected to be irritation of eyes and mucous membranes. Some protection is provided by thick skin and blubber. Entrained hydrocarbons may be ingested by cetaceans during feeding, particularly by baleen whales. Some species of

baleen whale, such as blue whales, may be seasonally present in areas affected by a worst-case spill during their migrations. There are no recognised areas of importance for whale feeding within areas predicted to be exposed to adverse concentrations of hydrocarbons, however opportunistic feeding may occur.

Dugong may also occur within the adverse exposure value for a HFO spill event at Ashmore Reef (BIA), however the modelling only predicts contact of shoreline oil above the adverse exposure values at low probability (3.6%). There is a lack of studies examining the effects of hydrocarbon spills on dugongs, although it is believed that the direct impacts of exposure would be similar to those on cetaceans. Like cetaceans, dugongs have thick skin and blubber which is expected to make them resilient to direct exposure. Dugong habitat is largely considered to consist of seagrass meadows, which are restricted to shallow waters. Modelling shows significant time to contact at the adverse exposure value for shoreline oil (176 hours) at the dugong BIA, indicating that any oil that reaches dugong habitat will have been heavily weathered prior to arrival.

Marine Reptiles

Stochastic modelling results indicated adverse exposure zones overlap the known distribution of several species of marine turtles and sea snakes. Saltwater crocodiles were also identified as potentially occurring within the adverse exposure zone; given the preferred habitat for saltwater crocodiles are freshwater rivers and estuaries, impacts to this species from the worst-case hydrocarbon spills are not considered credible. Various BIAs and habitat critical to the survival of marine turtles are present in the planning area (Section 7.7.10.2). This includes internesting and foraging BIAs for flatback, green, olive ridley, hawksbill turtles, and foraging BIAs for loggerhead turtles; habitat critical for flatback, green, olive ridley and Leatherback turtles.

Several shoals and banks occur in the vicinity of the Activity Area, which may be used as foraging areas by marine turtles (although none are recognised as BIAs). Impacts to benthic habitats and biota at these shoals and banks may result in a reduction of food for marine turtles. See Section 9.14.2.5.3 for further information on potential impacts to shoals and banks.

Modelling indicates the probability for accumulated hydrocarbons above the adverse exposure value from a HFO release at turtle nesting BIAs, including Browse, Cartier Island and Scott Reef South (7.6%, 1% and 7.6% respectively) (Table 9-119). Breeding and nesting activity occurs at these locations and they are classified as habitat critical for the survival of marine turtles in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017a). Marine turtles rely on nesting beaches seasonally to reproduce, which makes them vulnerable to impacts from hydrocarbon accumulated on shorelines, through oiling of nesting females and emergent hatchlings (Lauritsen et al. 2017). Potential impacts would be greatest during the peak nesting periods. A worst-case HFO release, given its persistent nature, may potentially result in large volumes of hydrocarbons accumulating at marine turtle BIAs above the adverse exposure value (Browse island 407 m^3, Cartier Island 233 m^3, Scott Reef South 102 m^3). Any accumulated hydrocarbons interacting with the nesting beaches is likely to represent the persistent fraction in the form of viscous liquid and as tar balls as the hydrocarbon weathers, potentially impacting of egg viability. Fresh hydrocarbons may have a significant impact on egg hatching success rate (Milton et al. 2002). Adult and juvenile turtles during nesting seasons may become coated in the hydrocarbon as they move to and from shore and may also ingest hydrocarbons as they pass through the affected area. While turtle eggs are unlikely to be exposed to shoreline hydrocarbons, as most turtles nest well above the high tide level, they may be directly exposed through the transfer of hydrocarbons from the oiled female turtle (Shigenaka 2001).

Marine turtles may be exposed to floating or evaporated hydrocarbons if they surface within a slick (e.g. for breathing, basking etc.), or to amine, entrained or dissolved oil if they swim through a subsurface plume. There is also a possibility of ingestion of weathered residues accumulating on shorelines from the HFO release. Exposure to floating or entrained hydrocarbons may result in external oiling, which could result in impacts such as inflammation or infection (Gagnon and Rawson 2010; Lutcavage et al. 1995; NOAA 2010). Dissolved hydrocarbons may result in toxic effects on marine turtles, however their relatively impermeable skin reduces the potential for these impacts. The high biodegradability and low probability (1%) of an amine spill overlap with green turtle habitat suggests impacts are unlikely.

Sea snakes have similar exposure pathways to sea-borne hydrocarbons as marine turtles. Sea snake mortality has been linked to exposure to hydrocarbon spills, with dead sea snakes recovered from the region of the Montara oil spill showing high levels of petroleum hydrocarbons (including PAHs) in the trachea, lungs and

stomach (Gagnon 2009). These results are consistent with exposure through ingestion and respiration of hydrocarbons. Ashmore Reef and Hibernia Reef are noted as being one of the few sites where the critically endangered leaf-scaled sea snake and short-nosed sea snake have been recorded, along with other species of sea snake, including the endangered dusky sea snake. The dusky, leaf-scaled and snort-nosed sea snakes have not been detected at Ashmore Reef or Hibernia Reef since 2001, despite increased biological survey effort (DCCEEW 2024h). The stochastic modelling indicates a very low probability and extended travel times for condensate above adverse exposure levels to affect these areas (Ashmore Reef 3.6%). In addition to Ashmore and Hibernia reefs, the known or likely dusky sea snake distribution within the Planning Area (DCCEEW 2024h) includes Heywood Shoals and the waters surrounding Cartier Island. The stochastic modelling indicates that, for a worst case release of condensate, shows a low probability (<1%) of entrained hydrocarbons above adverse exposure levels reaching these areas after relatively extended travel periods following release (e.g. 146 hrs for Heywood Shoals). Shoals closest to Prelude, such as Goeree, Vulcan and Eugene McDermott, where the dusky sea snake or its habitat may occur (DCCEEW 2024h) have a low probability of exposure to hydrocarbons above adverse thresholds (<2.3%) from a condensate release. No exposure to floating or entrained hydrocarbons above the high thresholds (i.e. 50 g/m^2 and 1000 ppb respectively) were predicted for any of these locations under any conditions modelled.

Sharks and Rays

Fish (including sharks and rays) respire through gills, which makes them more vulnerable to exposure to dissolved and entrained hydrocarbon fractions than air breathing fauna (cetaceans, marine reptiles, birds). However, despite this apparent vulnerability, increased mortality has rarely been observed to result from open-water hydrocarbon spills (Fodrie and Heck 2011; ITOPF 2011). Environmental monitoring of pelagic and demersal fishes immediately following the Montara oil spill indicated that fish were exposed to hydrocarbons, although no adverse effects were noted (Gagnon and Rawson 2011, 2012). Additional discussion of the likely mechanisms and consequences of exposure to hydrocarbons in fish is provided in Section 9.14.2.4.1.

Several species of transitory or resident threatened, and migratory sharks and rays may occur within the adverse exposure zones identified by the stochastic spill modelling. A foraging BIA for whale sharks has been identified within the adverse exposure zone. Contact is predicted at low probability for floating (4.6%) for a HFO release, and low probability for entrained (10.3%) and dissolved oil (4.3%) for a condensate release. Individual sharks are likely to be present within the areas that may be affected by a spill if it occurs during their migration to and from the aggregation area off Ningaloo Reef. While no aggregation areas are present within the area potentially affected by a spill at the adverse exposure value, migrating whale sharks may be exposed to entrained and dissolved hydrocarbons through contact with their gills or by ingestion during opportunistic feeding. The large volume filter feeding behaviour of whale sharks may result in a relatively high potential for exposure to entrained hydrocarbons compared to many other marine species (Campagna et al. 2011).

Tagging studies off Ningaloo Reef have shown that whale sharks disperse broadly (Meekan and Radford 2010; Wilson et al. 2006). Genetic studies of whale sharks have shown low genetic diversity, which suggests flow of genetic material through the movement of individual sharks over large spatial scales (Schmidt et al. 2009). On this basis, only a portion of the whale shark population in the Timor Sea would be within the area above the adverse exposure threshold at any one time and impacts such as toxic effects leading to mortality would be expected to affect a small number of individual animals.

Other oceanic species of sharks and rays are likely to occur throughout the adverse exposure zone, including around reefs and shoals/banks. However, Heyward et al. (2017) noted that shark numbers were lower than expected at these sites, potentially due to fishing pressure. Potential impacts to other oceanic shark species are likely to be similar to fish (see Section 9.14.2.4.1). Any reduction of shark numbers may take longer to recover due to the relatively long lifespans and low reproductive output compared to finfish species.

Birds

Many seabirds and migratory shorebird species have been identified as potentially occurring within a worst-case exposure zone (over 30 species of shorebird listed as migratory under the EPBC Act have been recorded at Ashmore Reef (DCCEEW 2024)). Additionally, several BIAs for seabird and migratory shorebird species occur throughout the adverse exposure zone, centred around offshore islands.

Seabirds and migratory birds are particularly vulnerable to contact with floating hydrocarbons, which can coat feathers. This can lead to hyperthermia from loss of insulation and may lead to toxic effects due to ingestion

of hydrocarbons when preening; both impacts may result ultimately result in mortality (Hassan and Javed 2011). The stochastic modelling indicates low probability (4.6%) of exposure to floating hydrocarbons above adverse thresholds within the bird BIAs that occur in the Planning Area (Section 7.7.10.4).

The most likely cause of seabirds encountering spilled hydrocarbons is during foraging for food. Seabird foraging is typically concentrated around roosting locations, such as offshore and coastal islands and reefs. Potential roosting locations lie a considerable distance from the Activity Area; the nearest significant roosting location is Ashmore Reef/Cartier Island, which lies 110 km away. Ashmore Reef is a Ramsar-listed wetland which hosts significant seabird colonies and is an important stopping area for migratory shorebirds. Hydrocarbons reaching these locations would be significantly weathered, reducing the potential for toxicity effects.

Migratory shorebirds are seasonally abundant during summer months, and a spill during this period would have greater potential to impact migratory shorebirds. These birds are not likely to encounter floating oil at sea but may be affected by shoreline accumulation of oil and waxy residue, or oil where shallow foraging habitats such as intertidal mudflats are present. Unlike seabirds, shorebird mortality due to hyperthermia is relatively uncommon but indirect impacts, such as reduced prey availability and bioaccumulations of PAHs, may occur (Henkel et al. 2012). Exposure to hydrocarbons that reduces the ability of shorebirds to use an important area of habitat for roosting or foraging, or reduces the availability of food, may have a significant impact (CoA 2017c). The spill modelling indicates that there is a low probability (1%) and extended (>312 days) minimum time after release for shoreline accumulation above threshold at Cartier Island, by which time the residues would highly weathered. Average maximum concentrations of entrained or dissolved hydrocarbons reaching the surrounding waters would be below adverse thresholds, suggesting widespread impacts are unlikely.

The maximum predicted extent of a hazardous liquid spill is comparatively smaller for MEG (21.5 km) and amine (39.9 km), and the lack of shoreline contact makes it unlikely to impact migratory shorebirds. Seabirds could be affected if foraging in the spill area, however typically this would be concentrated around roosting locations, none of which lie within the maximum predicted spill extent.

The residual risk to Natural Values and Sensitivities is ranked Yellow (Consequence: Massive, Likelihood: B-Remote) (see Table 9-121).

9.14.2.6 Socioeconomic Features, Values and Sensitivities

This section describes the potential impacts to socioeconomic features and values within the Planning Area in the event of a worst-case spill.

9.14.2.6.1 Fishing Industry

There are a number of commercial fisheries (Section 7.8.2) that have fishing zones that could be exposed to hydrocarbons in the event of a worst-case spill event. Potential impacts to commercial fishing activities from a worst-case hydrocarbon spill include (ITOPF 2011):

- displaced fishing effort from areas impacted by a spill or spill response activities
- damaged fish stocks, largely due to mortality or toxicity
- closing of fisheries by management agencies
- the inability to sell catch due to perceived or actual fish tainting of contamination
- oiling of fishing gear, particularly by floating or shallow entrained oil.

Several of the fishing zones that overlap the Planning Area do not support fishing activity (Section 7.8.2). A significant hydrocarbon spill would likely result in a temporary closure to fishing within the area of exposure, in particular the areas closest to the spill event. The spatial extent and duration of the closure would depend on the nature and scale of the pollution resulting from the hydrocarbon spill. Given the large spatial extent of managed fisheries in the Planning Area (see Section 7.8.2), a spill is unlikely to result in complete closure of any fishery. Rather, the closure of areas to fishing is more likely to result in the displacement of fishing effort. Displacement from productive fishing areas may result in impacts to fishers such as increased costs and reduced catch per unit effort.

Exposure of fish to hydrocarbons may result in tainting, which could render landings unsuitable for human consumption. Tainting may occur even at low levels of hydrocarbon exposure. Monitoring of fish for taint immediately following capping of the Montara well detected differences between fish likely to have been exposed to hydrocarbons, however these differences were not conclusively linked to oil contamination and fell within the range of 'normal' fish odours (Rawson et al. 2011). Samples collected at the same monitoring locations two and four months after were not distinguishable (Rawson et al. 2011). These results are consistent with other studies of fisheries resources exposed to hydrocarbon pollution, which acknowledge the potential for impacts to fisheries resources but have shown little potential risk for consumers if suitable fisheries management actions are undertaken (Law and Hellou 1999; Law and Kelly 2004).

Fish caught in areas affected by a significant hydrocarbon spill may be perceived as being of poorer quality, even if no decrease in quality is evident. This may result in lower prices at the time of sale and subsequently lead to reduced income for commercial fishers.

9.14.2.6.2 Tourism and Recreation

There are no known tourism or recreational activities in the Activity Area, or surrounds, due to the remoteness of the area. Some nature based tourism activities may occur at the remote offshore islands and reefs within the adverse exposure zones of a worst-case spill scenario. Impacts to the environmental values associated with these islands and reefs may affect their value for tourism activities. Refer to Offshore Reefs and Islands (Section 9.14.2.5.4) for discussion on the potential impacts to these receptors.

Mainland coastline and islands will typically host more nature-based tourist activities than offshore islands. This activity is expected to be seasonal, with increased visitation during the winter dry season months. Impacts to tourism activities are expected to be minor based on the likelihood and nature of contact to environmental values that support tourism activities. Impacts to these values may result in displacement of tourism activity, introduction of temporary exclusion zones or avoidance of areas with visible oil sheens, and a corresponding loss of revenue for tourist operators (e.g. charter fishing cancellations due to fishery closures).

Whilst direct impacts on tourism activities are unlikely to be significant, media, news and general perception of an area in the event of an ongoing spill could reduce visitor numbers and may result in more substantive financial losses for tourism operators.

9.14.2.6.3 Defence

Defence activities within the offshore North Australian Exercise Area (NAXA) are considered unlikely to be affected by the worst-case credible hydrocarbon spills. There is a possibility that activities may have to be temporarily displaced from areas where a spill response is underway or where spilled hydrocarbons may present a risk to vessels, but such displacement would be highly localised and temporary in nature. Open dialog channels exist with Defence allowing for clear communication in the event of a worst-case spill within the Activity Area.

9.14.2.6.4 Shipping

The modelling of a worst-case scenario does not predict any exposure to ports, and potential impacts to commercial shipping are expected to be minor, limited to temporary displacement of marine users from areas near the release and/or where spill response activities are underway, or additional demand for wharf/mooring space for loading/unloading vessels that are active in the field.

9.14.2.6.5 Scientific Research and Restoration

Scientific research programs that are being conducted within the Planning Area could be adversely affected by a worst-case spill. Studies concentrating on communities at shallow water features such as reefs, shoals and around islands, could be disrupted if a spill (or associated response) prevented access to areas, or the aims of the research could be adversely impacted if habitats or species of interest were affected by exposure to spilled hydrocarbons. Long-term studies focused in relatively shallow areas, such as at Scott Reef, may be particularly vulnerable. The stochastic modelling indicates that a number of reefs and shoals/banks, including Scott Reef, may be exposed to hydrocarbons above the adverse exposure value in the event of a worst-case spill. Potential for impacts to reefs, islands, shoals and banks are discussed in Section 9.14.2.5. Surveys of shoals in the region following the Montara oil spill indicated these communities did not exhibit obvious impacts as a result of the spill (Heyward et al. 2013, 2012, 2010).

9.14.2.6.6 Oil and Gas Industry

Petroleum activities in the region include the Shell operated Crux platform, the INPEX operated Ichthys facility and the Montara development (operated by Jadestone Energy). In the unlikely event of a worst-case spill scenario there is a risk that a reduction in water quality may occur with this leading to possible effects to the operation of these facilities, especially if seawater is no longer suitable for intake (e.g. for use as cooling water or feed water for RO water generation). This is likely to result in impacts to routine operations and could lead to a reduction in production output and thus a financial impact. A worst-case hydrocarbon spill response is also likely to result in competition for vessels and potentially drilling rigs (if well intervention or a relief well is required).

9.14.2.6.7 Indonesian and Timor-Leste Coastlines

The spill modelling results indicate there is the potential for condensate in reaching the Indonesian and Timor-Leste coastlines above the lowest exposure threshold, with a low (2%) probability of accumulating on shorelines. Maximum shoreline accumulation in the worst-case modelling for HFO showed 512 m^3 on Indonesian shorelines. The likelihood of entrained hydrocarbons above adverse impact thresholds reaching Indonesian and Timor-Leste waters (EEZ) was low (4.6%) No exposure to floating oil was predicted for any coastlines in Timor or Indonesia.

Given the relatively long time to contact, soluble aromatic hydrocarbon fractions are unlikely to be present, leaving relatively low toxicity residual hydrocarbons such as paraffins. Potential impacts may include smothering of coastal infrastructure (e.g. aquaculture, fishing equipment), which may result in localised economic impacts.

The residual risk to Socioeconomic Features, Values and Sensitivities is ranked Yellow (Consequence: Major, Likelihood: B- Remote) (see Table 9-121).

9.14.2.7 Heritage and Cultural Features, Values and Sensitivities

9.14.2.7.1 Underwater Cultural Heritage

There are numerous sunken vessels, aircraft and other culturally significant underwater sites and artefacts within the Planning Area. However, these are unlikely to be impacted by a worst-case spill event due to the buoyant nature of the oils that could be involved and the modelling results showing the limited depths affected by entrained and dissolved hydrocarbons (<50 m).

Due to the nature of oil and the predicted trajectory and fates of a worst-case release, it is unlikely that an oil spill would have a significant impact on UCH within the Planning Area.

9.14.2.7.2 Traditional Indonesian Fishing

Oil spill modelling indicates there is limited potential for adverse effects within Indonesia's EEZ due to a worst-case spill in the Activity Area (Section 9.14.2.6.7). However, traditional Indonesian fishing activity occurs within the MoU Box, which intersects the Activity Area (See Section 7.8.2). Traditional fishing is concentrated around banks, shoals, island and reefs. The worst-case credible spill scenarios may impact upon the biological resources exploited by traditional Indonesian fishers, such as fish and benthic invertebrates (e.g. sea cucumbers and trochus shells). Impacts to these biological resources may result in effects on traditional fishers, such as reduced catch rates and displacement of fishing effort.

9.14.2.7.3 Indigenous Cultural Heritage

There are no known Indigenous cultural heritage features or values that exist within the Activity Area and Shell has received advice that it is highly unlikely that any tangible cultural heritage values will exist below the 130 m water mark which is the accepted maximum extent of the ancient coastline (Cosmos Archaeology 2023). A recent review of the NT AAPA Sacred Site Register has identified four registered sacred sites within the planning area. These sacred sites are predominantley located along the mainland and island coastlines within the intertidal zones. In shallower water depths it is highly unlikely that underwater cultural heritage features would be impacted as the oil that may be released by a worst-case spill event is buoyant and remains in the surface waters. Due to the nature of oil and the predicted trajectory and fates of a worst-case release, it is unlikely that an oil spill would have a significant impact on sacred sites with coastal and intertidal zones.

Consultation has confirmed that Indigenous people have a strong connection to sea Country (as described in Section 7.9). Shell has been made aware of the existence of song lines along the West Kimberley Coastline, a culturally sensitive reef in the Kimberly region, as well as an ancient ceremonial site of the Bardi Jawi people underwater on the Dampier Peninsula coast. Oil spill modelling predicts exposure to hydrocarbons above threshold levels along Australian shores where tangible and intangible cultural heritage is known to exist. In the event of worst-case spill Shell will enact its BROPEP and OSMP and has procedures in place to ensure traditional owners are informed of a spill and dialog remains open between Shell and traditional owners to obtain advice on cultural features and values and inform appropriate response.

The residual risk to heritage and cultural features is ranked Yellow (Consequence: Major, Likelihood: B-Remote) (see Table 9-121).

9.14.3 Risk Assessment Summary

The risk assessment summary in Table 9-121 is based on the worst-case consequence emergency spill events. It lists the highest residual risk ranking of the relevant environmental receptor groups for emergency events.

Table 9-121: Emergency Events Evaluation of Residual Risks

Environmental Receptor	Consequence	Likelihood	Residual Risk
Evaluation – Unplanned Risks			
Protected Areas	Major	B – Remote	**Yellow**
Physical Features	Minor	B – Remote	**Dark Blue**
Physical Values and Sensitivities	Major	B – Remote	**Yellow**
Natural Features	Minor	B – Remote	**Dark Blue**
Natural Values and Sensitivities	Massive	B – Remote	**Yellow**
Socioeconomic Features	Major	B – Remote	**Yellow**
Socioeconomic Values and Sensitivities	Major	B – Remote	**Yellow**
Heritage and Cultural Features	Major	B – Remote	**Yellow**
Heritage and Cultural Values and Sensitivities	Major	B – Remote	**Yellow**

9.14.4 ALARP Assessment and Environmental Performance Standards

Table 9-122: Emergency Events - ALARP Assessment and Environmental Performance Standards

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Elimination	None identified.	N/A	N/A	N/A	N/A	N/A
Substitution	Substitute MEG, Amine with less hazardous chemicals.	No	MEG and amine (MDEA) have been selected based on their performance and non-hazardous HSE properties. MEG is classified as PLONOR and is also considered as non-persistent in the environment and does not bioaccumulate. Amine (MDEA) is biodegradable and exhibits low toxicity. Additionally amine is used in closed systems and is not intended to be disposed to the marine environment.	N/A	N/A	N/A
Substitution	Use of diesel-fuelled vessels rather than HFO or IFO.	Yes	Shell has mandated the use of lower persistent fuels within the exclusion zone of Prelude, however, offtake tankers may still carry HFO within holding tanks. Whilst the probability of a HFO release is reduced, it is still credible.	12.1	Vessels are MDO or MGO fuelled.	Vessels are MDO or MGO fuelled.
Engineering	FLNG is double hulled.	Yes	Prelude FLNG is double-hulled except for the area around the hull thrusters as purposefully designed. In addition, the condensate storage tanks are surrounded by ballast water tanks which provide additional protection in case of a hull breach.	N/A	N/A – Prelude FLNG is permanently installed (moored) and commissioned at the time this EP commenced, and is therefore not described in further detail here as an EPS.	N/A
Engineering	Condensate offloading hoses have Marine Breakaway Coupling (MBC).	Yes	The MBC is designed to prevent oil spills and protect the transfer system from damage in the event of a tanker breakout or an excessive pressure surge.	12.2	Condensate offloading hose is equipped with an MBC.	Records demonstrating presence of an MBC on the condensate offloading hose.
Engineering	Radars/ Automatic Identification System (AIS)/ Automatic Radar Plotting Aid (ARPA) and associated alarms on FLNG, infield support vessels and supply vessels.	Yes	Use of radars/ Automatic Identification System (AIS)/ Automatic Radar Plotting Aid (ARPA) and associated alarms on FLNG, infield support vessels and supply vessels. This technology allows early identification and notification of approaching vessels and is crucial in minimising the risk of vessel-to-vessel collision. All product off-loading activities are done in accordance with the Prelude Terminal Information Book (OPS_GEN_004647) which includes specific collision prevention procedures and measures including: • Controlled speed for all marine vessels in the PSZ • Ability for three way communication between FLNG, infield support vessels and offtake vessel • The PSZ is patrolled by support vessels • FLNG radar/ ARPA and associated alarms monitored for approaching vessels • Vessels follow pre-determined access routes to the FLNG and assess environmental conditions (wind, current and sea state) • Contractual requirement for vessels to be manned by competent crew • All contracted vessels employed are subjected to a stringent assurance process, and • Product offtake tankers are assisted by Prelude infield support vessels and piloted by Prelude FLNG marine pilots to ensure safe berthing/offloading/bunkering/de-berthing.	12.3	Product offtake tankers are assisted by Prelude infield support vessels.	AIS information shows offtake tankers being assisted by Prelude infield support vessels.
				12.4	Product offtake tankers are piloted by competent marine pilots to ensure safe berthing/offloading/de-berthing.	Pilot Competency Assurance records.
				12.5	The FLNG and supporting vessels are equipped with suitable and operational navigation and collision avoidance equipment, specifically: • ARPA • AIS • Associated alarms • Radar, and/or • Equivalent system.	Marine Assurance records.
				12.6	Topsides AIS maintained in accordance with the CMMS.	CMMS records for topsides AIS.
Engineering	Real Time Metocean Monitoring System.	Yes	Metocean data gathering system provides a Real Time Metocean Monitoring System to alert personnel to adverse weather by providing accurate, continuous, real-time metocean data for decision making when	12.7	Topsides are equipped with Real Time Metocean Monitoring System.	Platform As Built drawings show the topsides are equipped with Real Time Metocean Monitoring System.

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
			conducting weather sensitive activities to help prevent weather related incidents.			
Administrative and Procedural	Infrastructure and PSZ locations communicated to AHO to allow inclusion on maritime charts.	Yes	Inclusion of facilities and PSZ on maritime charts will allow other marine users to navigate accordingly to avoid adverse interactions with Prelude facilities and restricted areas. This control is also consistent with standard industry practice.	1.1	Active PSZ notification and infrastructure locations issued through AHO.	Consultation records show information was provided to AHO.
Administrative and Procedural	Give a minimum of four weeks' notice of commencement of activities under this EP to the AHO to enable a 'Notice to Mariners' to be issued.	Yes	Allows notifications to be made to other marine users in the area to minimise interaction with vessels and reduce the risk of collisions.	1.2	AHO is notified, at least four weeks prior, to enable a 'Notice to Mariners' to be issued before any specific vessel based activities outside of the PSZ, but within the Activity Area, commence.	Consultation records show sufficient information provided to AHO to generate 'Notice to Mariners' at least four weeks prior to any specific vessel based activities outside of the PSZ, but within the Activity Area, commencing.
Administrative and Procedural	Prohibit vessels from anchoring in the Activity Area except in emergency events.	Yes	No support vessel anchoring in the Activity Area except in emergency situations.	4.1	No vessel anchoring associated with the activities, except in emergency events.	Vessel logs confirm no vessels used anchors within the Activity Area.
Administrative and Procedural	Lifting procedures and maintenance, including inspection of lifting equipment.	Yes	Lifting, maintenance and inspection procedures are implemented for all lifting operations on Prelude. Shell Australia has a Lifting and Hoisting Manual (OPS_GEN_010724) and a Prelude specific Lifting and Hoisting Operations Supplement (OPS_PRE_010176), as well as a Prelude Lifting and Hoisting Operations Procedure (OPS_GEN_ 015990), which is mandatory for all lifting operations on the Prelude facility. The Manual and supplement specifies lifting requirements, performance standards and roles, responsibilities and competency requirements to reduce the risk of dropped objects impacting the seabed and sea infrastructure potentially resulting in damage or a loss of containment of hydrocarbons. The Prelude procedure specifies the operational controls for the planning and management of lifting activities, managing lifting appliances and lifting accessories and competency or persons performing roles associated with safe lifting and hoisting operations. Consideration of dropped objects is required as a consideration for all lifts.	4.2	Prelude lifting operations comply with the Prelude Lifting and Hoisting Operations Procedure which includes the following controls, to reduce the risk of dropped objects entering the marine environment: • defined roles, responsibilities and competency requirements • pre-lift checks and briefings • restricted operations due to weather and helicopter operations • lift plans in place with consideration of dropped objects • Recommended "No Lift' sectors for Crane A, C and F • Risk assessment for overboard lifts using Crane A	Evidence of compliance with the Lifting and Hoisting Procedure as demonstrated by the Shell Assurance Process, including records such as: • Training records demonstrate competency requirements in accordance with the Procedure • Records of pre-lift checks and briefings • Lift plans with evidence of dropped object consideration. • Risk assessment for overboard lifts using Crane A • SAP records Incident reports demonstrate no incidents of spills or release of equipment, materials or waste to the ocean from lifting activities.
Administrative and Procedural	Shipboard Oil Pollution Emergency Plan (SOPEP) or equivalent (appropriate to class of vessel).	Yes	SOPEP (or equivalent) shall be in place for all vessels as required by their class in accordance with AMSA Marine Order 91. This system control measure enables the efficient and prompt response to hydrocarbon releases, thereby reducing potential impacts to the marine environment.	11.3	Vessels have and implement a valid SOPEP (appropriate to class) to respond to spills.	A valid SOPEP (appropriate to class) in place.
Administrative and Procedural	FLNG and Vessel Bunkering Procedures for Hydrocarbons and Chemicals.	Yes	The purpose of these procedures is to ensure that good practice and industry standards are applied during bunkering operations. Implementation of these procedures will minimise the risk of a spill incident through e.g. both facilities prepared for bunkering, drains plugged, approved bunker plan for specified volumes, designated receiving tanks and agreed pumping rates, direct communication between all involved and supervision at both ends and availability of spill kits onboard each vessel/facility.	12.8	Bunkering procedure will be implemented to minimise the risk of bunkering spills to the ocean, which includes: • Check hoses prior to commencement. • visually monitor gauges, hoses, fittings and the sea surface during the operation. • Implement a completed PTW and/or JSA for the hydrocarbon bunkering operation.	Records demonstrate bunkering undertaken in accordance with Shell bunkering procedures as required.
Administrative and Procedural	Subsea control operators are competent.	Yes	Subsea control operators are trained and competent in the operation and monitoring of the hydrocarbon system.	12.9	Subsea control operators are competent in the operation and monitoring of the hydrocarbon system	Competency assurance records
Administrative and Procedural	NOPSEMA accepted WOMP.	Yes	Maintenance of well integrity is a key requirement to avoid loss of well control. The wells at Prelude are covered by NOPSEMA accepted WOMP that details key controls in place for the duration of the well lifecycle.	N/A	N/A	N/A Accepted WOMP in place for Prelude wells to manage risks associated with well operations

Hierarchy of Controls	Control Measure	Adopted?	ALARP Discussion and Control Measure Effectiveness	EPS #	EPS	Measurement Criteria
Administrative and Procedural	NOPSEMA accepted Safety Case.	Yes	In accordance with the OPGGS (Safety) Regulations 2009, all key activities will be undertaken in accordance with the accepted Prelude safety case.	N/A	N/A	N/A Accepted safety case in place for Prelude to manage risks associated with operations
Administrative and Procedural	Marine Support vessels are equipped and crewed in accordance with Australian maritime requirements Marine Order 21, Marine Order 27, Marine Order 30 and Marine Order 71.	Yes	The vessels within the Activity Area will adhere to the navigation safety requirements contained within the International Regulations for Preventing Collisions at Sea 1972 (COLREGS), Chapter 5 of the International Convention for the Safety of Life at Sea 1974 (SOLAS Convention), International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention), the *Navigation Act 2012* (Cth) and any subsequent Marine Orders, which specify standards for crew training and competency, navigation, communication, and safety measures. Reduces the likelihood of vessel collision by operating the vessels in accordance with industry standards and regulatory requirements.	1.3	Vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including implementing: • Marine Order 21 (Safety and emergency procedures), including: ○ safety measures such as manning and watchkeeping. • Marine Order 27 (Safety of navigation and radio equipment), including: ○ radio equipment and communications. ○ navigation safety measures and equipment. ○ danger, urgency and distress signals and messages. • Marine Order 30 (Prevention of Collisions), including: ○ lights and signals as applicable to vessel class per COLREGS requirements. • Marine Order 71 (Masters and Deck Officers), including: ○ all master, mate and watchkeeper officer duties undertaken by crew certified as applicable to vessel class per STCW Convention) requirements.	Marine assurance records demonstrate compliance with navigation safety requirements including: • A Minimum Safe Manning Certificate is in place and identifies minimum crew qualifications to meet the STCW Convention requirement. • Records of vessel crew STCW Convention qualifications align with the Minimum Safe Manning Certificate (as applicable for vessel size, type and class). • A Vessel Cargo Ship Safety Equipment Certificate demonstrates the vessel has lights, shapes and means of making sound signals and distress signals in accordance with COLREGS requirements (as applicable for vessel size, type and class). • Records of Shell's marine vessel assurance process (as applicable for vessel size, type and class).
Administrative and Procedural	Accepted OPEP and OSMP.	Yes	Implements response plans to deal with an emergency event quickly and efficiently to reduce impacts to the marine environment.	N/A	N/A – refer to the NOPSEMA accepted BROPEP (HSE_GEN_016765) and Browse Regional OSMP (HSE_PRE_016370) for the applicable EPS.	N/A
Administrative and Procedural	Operator Start of Shift Orientation (SoSO) rounds implemented as per Section 10.5.6.3 and 10.9.2.	Yes	The SoSO is a time bounded, usually at the start of each shift, initial familiarisation of the Asset generally performed between shift handover and shift team meeting (except for geographically dispersed locations which perform the SoSO after the shift team meeting.) The SoSO is meant to confirm the status of the Asset matches what was heard during the shift handover and prepares the individual to contribute to the shift team meeting.	12.10	Operator Start of Shift Orientation (SoSO) rounds are implemented daily to maintain situational awareness of the facility.	Daily SoSO round records.

ALARP Statement

Given the impact assessment outcomes and control measures adopted under the scope of this activity, Shell considers implementing of the control measures appropriate to manage the potential risk and impacts associated with emergency events. No feasible additional controls were identified that could further reduce the impacts. Therefore, the impacts are reduced to ALARP.

9.14.5 Acceptability of Risks

Table 9-123: Acceptability of Risks – Emergency Events

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Sub-category**			
Protected areas	Marine conservation reserves	No impacts to the values of marine parks.	Yes	Shell considers large-scale releases of hydrocarbons during the Activity to be unacceptable. Such spills have potential to result in significant environmental impacts. This has been reinforced through consultation with groups such as DAC and WGAC. Consequently, Shell will apply its considerable experience and knowledge in the offshore petroleum industry to ensure no such release occurs. Shell has applied a conservative approach to the identification and modelling of the credible worst-case hydrocarbon spills. This information was used to inform the evaluation of the environmental risks and is consistent with the precautionary principle. Shell will implement industry standard controls to manage the risk of emergency events (unplanned hydrocarbon spills). The BROPEP (HSE_GEN_016765) will support the activity that is commensurate to the nature and scale of the hydrocarbon spill risks.
	Wetlands of international and national importance	No impacts to the ecological values of wetlands of international and national importance.	Yes	
	Commonwealth and national heritage places	No impacts to Commonwealth or national heritage places values.	Yes	
Physical features, values and sensitivities	Marine regions	No significant impacts to the physical features of a marine region.	Yes	
	Air quality	No significant impacts to air quality defined as no substantial change in air quality which may adversely impact on biodiversity, ecological integrity, social amenity, or human health.	Yes	
	Water quality	No significant impacts to water quality. Impact not expected to result in a substantial change in water quality, which may adversely impact biodiversity, ecological integrity, social amenity or human health.	Yes	
	Sediment quality	No significant impacts to sediment quality. Impact not expected to result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that	Yes	

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Sub-category**			
		biodiversity, ecological integrity, social amenity or human health may be adversely affected.		
Natural features, values, and sensitivities	Marine bioregions	No significant impacts to benthic habitats and communities. No significant adverse effect on pelagic communities, populations, habitats or spatial distribution of a species.	Yes	
	BIA	No significant impact to functional values of BIAs.	Yes	
	Critical habitat	No significant impact to functional values of critical habitat.	Yes	
	Shoals and banks	No direct impacts to named banks and shoals. No loss of coral communities at named banks or shoals as a result of indirect/offsite impacts[91].	Yes	
	Offshore reefs and islands	No significant impacts to offshore reefs and islands.	Yes	
	KEFs	No significant impacts to environmental values of KEFs.	Yes	
	Threatened, migratory, marine and cetacean species	No mortality or injury of cetaceans	Yes	

[91] As defined in the Matters of National Environmental SignifiNo Morcance: Significant Impact Guidelines 1.1 (DoE 2013).

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Sub-category**			
		Management of aspects of the activity must align with conservation advice, recovery plans and threat abatement plans. No significant impact to EPBC listed threatened, migratory, marine or cetacean species.		
Socioeconomic, features, values and sensitivities	Fishing industry	No negative impacts to targeted fisheries resource stocks that result in demonstrated loss of income for commercial fisheries. Temporary displacement of fishing activities within the Activity Area (excluding PSZs) is acceptable. Permanent exclusion of fishing activities from PSZs is acceptable	Yes	
	Tourism & recreation	No negative impacts to nature-based tourism resources resulting in demonstrated loss of income. Temporary displacement of tourism activities within the Activity Area(excluding PSZs is acceptable.	Yes	
	Defence	Temporary displacement of commercial shipping within the Activity Area (excluding PSZs) is acceptable.	Yes	
	Ports and commercial shipping	Temporary displacement of commercial shipping within the Activity Area (excluding PSZs) is acceptable.	Yes	

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Sub-category**			
	Oil and Gas industry	Temporary displacement of petroleum exploration activities and operations within the Activity Area (excluding PSZs) is acceptable.	Yes	
	Scientific research/restoration	No impacts resulting in abandonment of long-term established scientific research restoration programs. Temporary displacement of scientific research and restoration within the Activity Area. Permanent displacement of scientific research and restoration within the petroleum safety zone (excluding activity specific programs)	Yes	
	Indonesian & Timor Leste Coastlines	No impacts to Indonesian or Timor-Leste coastlines or nearshore environments are acceptable.	Yes	
Heritage and cultural features, values and sensitivities	Indigenous cultural heritage values	No significant impacts to Indigenous cultural heritage values.	Yes	
	Underwater cultural heritage	No damage or destruction to historical shipwrecks and sunken aircraft is acceptable.	Yes	
	Traditional Indonesian fishing	No negative impacts to exploited fisheries resource stocks.	Yes	

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	Sub-category			
		Temporary displacement of traditional fishing activities within the Activity Area (excluding PSZ) is acceptable. Permanent exclusion of traditional fishing activities from gazetted petroleum exclusion zones is acceptable.		

A comprehensive assessment of the risks from the worst-case credible spill scenarios arising from the activity has been undertaken. Globally, Shell has experience in similar activities and understands the possible impacts and risks that may arise from these worst case credible spill scenarios. Shell has undertaken in-depth environmental studies, analytical modelling and consultation to identify the environmental receptors that may be affected and understands the nature and implications of potential hydrocarbon pollution within the Planning Area. These studies undertaken, along with Shell's organisational experience, allows for a high degree of confidence to be placed in the outcomes of the assessment of the risks.

The assessment of risks determined a highest residual risk ranking of Yellow (Table 9-121). The acceptability of the potential risks of impacts from emergency events associated with the petroleum activities has been considered in the following context:

Principles of ESD

EPOs aligned with the principles of ESD and the precautionary principle have been adopted by putting in place extensive controls to prevent marine accidents. In the unlikely event of a spill, plans are in place to mitigate the impact and prevent serious or irreversible environmental damage.

Relevant Requirements

Managing the potential impacts and risks from emergency events is consistent with legislative requirements, including:

Compliance with international maritime conventions, including:

- STCW Convention
- SOLAS
- COLREGS
- MARPOL: Annex I: prevention of pollution by oil and oily water.

Compliance with Australian legislation and requirements, including:

- Navigation Act 2012 (Cth) and Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth):
  - Marine Order 21 (Safety of Navigation and Emergency Procedures
  - Marine Order 27 (Radio Equipment)
  - Marine Order 30 (Prevention of Collisions)
  - Marine Order 71 (Masters and Deck Officers)
  - Marine Order 91 (Marine Pollution Prevention – oil).
- OPGGS Act 2006 and OPGGS (E) Regulations:
  - accepted EP, BROPEP and OSMP for all petroleum activities associated with the activity.
- Implementation of recognised industry best practices, such as:
  - agreements in place with oil spill response service providers
  - development of SIMOPS plans.

Matters of National Environmental Significance

A worst-case hydrocarbon spill may have the potential to result in significant impacts for several MNES. Shell will put in place a range of measures during the activity to ensure that spills of hydrocarbons that may have the potential to result in significant impacts to threatened and migratory species do not occur. Shell considers the residual risk to these MNES to be acceptable, after application of the key management controls proposed in this EP.

Marine Parks

Modelling results of the worst-case credible spill scenarios predicted that Commonwealth marine parks may have the potential to be contacted above adverse exposure thresholds.

Commonwealth and National Heritage Places

Although considered very unlikely, predictions from the stochastic spill modelling studies indicate hydrocarbons above impact exposure thresholds may have the potential to contact the Ashmore Reef National Nature Reserve Commonwealth Heritage Place (3.6% probability without controls in place) and Scott Reef and Surrounds (3%).

Threatened and Migratory Species

With controls in place, significant impacts (Table 9-122) to threatened and migratory species from a spill are considered unlikely. Pollution from hydrocarbon spills is recognised as a threat in management plans, recovery plans and conservation advice for a number of threatened and migratory species.

Table 9-124 summarises the alignment of the activity with these documents.

Wetlands of International and National Importance

Although considered very unlikely (due to the distance from the Activity Area), predictions from the stochastic spill modelling studies predict hydrocarbons above adverse thresholds may have the potential to contact the Ramsar wetland at Ashmore Reef (2.6%) and Cobourg Peninsula (0.6%) without controls in place.

Commonwealth Marine Environment

The evaluation of impacts and risks indicates that significant impacts to the Commonwealth marine environment may have the potential to occur in the event of a significant hydrocarbon spill. Any widespread impacts to water quality could result in several marine species being affected.

Table 9-124: Summary of Alignment with MNES Considerations

MNES	MNES Acceptability Considerations	Demonstration of Alignment
Marine Mammals	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1)	Shell has identified the potential for hydrocarbon pollution, and potential consequential habitat degradation, from an emergency event as a significant environmental risk. Shell has applied a range of controls that are intended to reduce the likelihood of such a release occurring, and mitigative controls to understand and reduce the severity of potential impacts if such a release occurred. Large-scale emergency events pose a significant safety risk for Shell personnel. Control measures and considerable effort will be applied to the project operations to reduce the likelihood of hydrocarbon releases occurring.
	Conservation management plan for the blue whale: A recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999* (CoA 2015a)	
	Approved Conservation Advice *Balaenoptera borealis* (sei whale) (DoE 2015c)	
	Conservation Advice *Balaenoptera physalus* fin whale (TSSC 2015b)	
	Conservation advice for *Orcaella heinsohni* (Australian snubfin dolphin) (DCCEEW 2025a)	
	Conservation advice for *Sousa sahulensis* (Australian humpback dolphin) (DCCEEW 2025b)	
Marine reptiles	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1)	
	Recovery plan for marine Turtles in Australia 2017–2027 (CoA 2017b)	

MNES	MNES Acceptability Considerations	Demonstration of Alignment
	Conservation Advice for *Aipysurus fuscus* (dusky sea snake) (DCCEEW 2024h). Refer to Table 9-125 for a summary of acceptability.	
	Approved Conservation Advice for *Aipysurus apraefrontalis* (short-nosed sea snake) (TSSC 2010a)	
	Approved Conservation Advice for *Aipysurus foliosquama* (leaf-scaled sea snake) (TSSC 2010b)	
Birds	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1)	
	Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015a)	
	Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (CoA 2017c)	
	Wildlife Conservation Plan for Seabirds (CoA 2020)	
	Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher) (DCCEEW 2024e)	
	Approved Conservation Advice on *Rostratula australis* (Australian Painted Snipe) (TSSC 2013)	
	Conservation Advice *Calidris ferruginea* curlew sandpiper (DCCEEW 2023f)	
	Conservation Advice *Numenius madagascariensis* eastern curlew (DCCEEW 2023e)	
	Conservation Advice *Anous tenuirostris melanops* (Australian lesser noddy) (TSSC 2015c)	
	Conservation Advice *Calidris canutus* red knot (DCCEEW 2024n)	
	Conservation Advice for *Phaethon rubricauda westralis* (Indian Ocean red-tailed tropicbird) (DCCEEW 2023h)	
	Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper) (DCCEEW 2024a)	
	Conservation Advice *Charadrius leschenaultii* greater sand plover (DCCEEW 2023g)	
	Conservation Advice *Phaethon lepturus fulvus* (white-tailed tropicbird, Christmas Island) (TSSC 2014c)	

MNES	MNES Acceptability Considerations	Demonstration of Alignment
	Approved Conservation Advice for *Limosa lapponica menzbieri* (Yakutian bar-tailed godwit) (DCCEEW 2024d)	
	Conservation Advice *Limosa lapponica baurei* (Alaskan bar-tailed godwit) (DCCEEW 2024c)	
	Conservation advice for *Calidris tenuirostris* (great knot) (DCCEEW 2024)	
	Conservation advice for *Pluvialis squatarola* (grey plover) (DCCEEW 2024)	
	Conservation advice for *Tringa nebularia* (common greenshank) (DCCEEW 2024)	
Sharks and Rays	Significant impact guidelines for critically endangered, endangered, vulnerable and migratory species (Table 8-1)	
	Conservation Advice *Rhincodon typus* (whale shark) (DoE 2015e)	
	Recovery plan for the white shark (*Carcharodon carcharias*) (DSEWPaC 2013)	
	Sawfish and river shark multispecies recovery plan (CoA 2015b)	
	Approved Conservation Advice for *Pristis clavata* (dwarf sawfish) (TSSC 2009)	
	Approved Conservation Advice for *Pristis zijsron* (green sawfish) (TSSC 2008b)	
	Approved Conservation Advice for *Glyphis garricki* (northern river shark) (TSSC 2014a)	
	Conservation Advice for P*ristis pristis* (largetooth sawfish) (DCCEEW 2025l)	
	Approved Conservation Advice for *Glyphis glyphis* (speartooth shark) (CoA 2014b)	
Commonwealth Marine Environment	Significant impact guidelines for Commonwealth marine environment (Table 8-1)	

Table 9-125: Summary of Acceptability and Regard given to the Conservation Advice for Aipysurus fuscus (dusky sea snake) (DCCEEW 2024h)

Threat	Applicable Conservation Advice for *Aipysurus fuscus* (dusky sea snake)	Assessment of Acceptability and Regard given to Conservation Advice *Aipysurus fuscus* (dusky sea snake)
Fossil fuel exploration and extraction		
Oil Pollution	Use scientifically informed planning and regulation to avoid impacts across the known and likely distribution of the dusky sea snake, including for development of the Torosa gas field and elsewhere	Shell follows scientifically informed spill response planning and associated regulations that enforce this. This is outlined within the BROPEP and Browse Regional OSM BIP. Measures to reduce the risk and impact of oil spill to “ALARP” and

	across the Browse basin. This includes (but is not limited to) eliminating: • The risk of oil spill affecting the dusky sea snake and its habitat.	"acceptable" are set out in Table 9-122 and Table 9-123.
	Ensure there is an effective strategy and adequate local resources and knowledge in place to rapidly respond to a large unintentional oil spill from gas and oil projects in the Browse Basin.	Section 9.15 includes a detailed assessment of oil spill response strategies and spill impact mitigation assessment. Attachment 1 of the BROPEP (Basis of Design and Field Capability Assessment) includes a capability assessment for resource availability in the event of an emergency event oil spill. This includes an effective strategy and adequate local resources and knowledge in place to rapidly respond.
	Should an oil spill occur that may impact the known or likely distribution of the dusky sea snake: • Urgently use herding agents, bioremediation agents and mechanical means to contain and break down the oil. See Australian Maritime Safety Authority: oil spill control agents. • Urgently cap or otherwise isolate the source of the oil to prevent further contamination. *Immediately resource and mobilise multiple expert wildlife care teams to search for, and rehabilitate, ill dusky sea snakes (and other threatened and priority taxa). Ensure there is sufficient expertise within the care team to assess the condition of sea snakes at sea for release or rehabilitation, effectively collect samples from live individuals for toxicology and pathology assessments, and safely collect and freeze deceased individuals for necropsy, pathology, and toxicology assessment.*	It is noted that not all response strategies are appropriate for application for every oil spill scenario. Given this, Shell utilises a Spill Impact Mitigation Assessment (SIMA) to consider the response strategies that may need to be implemented to provide the most effective response. The SIMA (both strategic and operational) takes into account the broad environmental context of the spill, including environmental values and sensitivities, and potential environmental outcomes for marine reptiles. The intent of the SIMA is to minimise the overall impact environmental impact of the spill (i.e. not just to minimise the impact to a single species). Measures to reduce the risk and impact of an oil spill to "ALARP" and "acceptable" are set out in 9.14.4 and the associated BROPEP; including consideration of a range of response strategies (such as source control and oiled wildlife response). Attachment 1 of the BROPEP (Basis of Design and Field Capability Assessment) includes a capability assessment for oiled wildlife response, including the provision of multiple trained oiled wildlife experts/advisors. The Browse Regional OSMP requires arrangements to be in place for suitably qualified personnel to implement the Operational Monitoring Plan (OMP): Marine Fauna Assessment – Reptiles along with the Scientific Monitoring Plan (SMP) Marine Megafauna Reptiles, which both includes provision for the assessment of sea snakes to determine appropriate management and response actions during an oil spill event to minimise the potential impact to sea snakes. The OMP also includes provisions for necropsy and analytical testing of deceased sea snakes.

External Context

No objections or claims have been raised by relevant persons to date regarding emergency events. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4.

Internal Context

Shell has considered the internal context, including Shell's environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented for the activity are consistent with the outcomes from consultation for the petroleum activity and Shell's internal requirements.

Shell will continue to maintain an appropriate spill response framework, which includes regular testing of the response arrangements as per Section 10.15

Acceptability Summary

Given the significant consequences of the risks associated with a worst-case hydrocarbon spill Shell has undertaken an extensive, conservative risk assessment and will apply a range of controls consistent with relevant requirements and industry best practice.

The acceptability of the potential impacts and risks from unplanned spills associated with the activity has been considered in the context of:

- The established acceptability criteria
- ESD
- relevant requirements
- MNES
- external context (i.e. relevant persons claims or objections)
- internal context (i.e. Shell requirements).

Shell considered the risk of emergency events associated with the activity to be ALARP and acceptable.

9.14.6 Environmental Performance Outcome

EPO #	EPO	Measurement Criteria
2.1	No injury or mortality of threatened, migratory or cetacean species associated with the Activities.	Reports of injury or mortality of EPBC listed threatened, migratory or cetacean species associated with the Activities sent to NOPSEMA and DCCEEW in accordance with requirements outlined in Table 10-13.
4.3	No incidents of spills or the release of equipment, materials or waste to the ocean from the activity	Incident reports demonstrate no incidents of spills or the release of equipment, materials or waste to the ocean from the activity.

9.15 Oil Spill Response Strategies

9.15.1 Spill Impact Mitigation Assessment

As described in the Spill Impact Mitigation Assessment (SIMA) presented in the BROPEP (HSE_GEN_016765), not all response strategies apply for every spill scenario (Section 9.14.1.6) and a combination of response strategies may need to be implemented for an effective response dependent on spill location, size and duration.

In most spill scenarios (Section 9.14.1.6), source control and surveillance, modelling and visualisation (SMV) spill response strategies will be implemented as relevant to the nature and scale of the spill. For spills involving light oils like condensate and diesel, response options such as containment and recovery or dispersant use are often ineffective due to rapid spreading, dispersion, and evaporation in the marine environment. In contrast, these strategies can be more effective and are commonly used as primary or secondary responses for HFO releases.

The available spill response strategies across multiple spill scenarios that are applicable to the Browse Region are assessed in the BROPEP. In the event of a vessel collision, the source control actions described in the vessel(s) SOPEP would also be initiated. An ALARP assessment of the BROPEP oil spill response strategies that are applicable to the activity is provided in Table 9-126.

Capability, readiness and implementation requirements for the specific spill response strategies are addressed in the BROPEP, which includes control measures and EPSs and EPOs around the required level of performance of each response strategy, and hence are not repeated in this EP.

Table 9-126: ALARP assessment of oil spill response capability

Oil Spill Response Strategy	Resources	Environmental gain from increasing or improving resources	Alternatives considered	ALARP assessment
Source Control				
Site survey	**Documents:** • East Browse Basin Source Control Emergency Response Plan **Equipment:** • Vessel. • Aircraft. **Personnel:** • Source Control Branch. • Aerial observers (Shell operations personnel).	A site survey involves the use of a vessel and/or aircraft to conduct visual observations of the surface infrastructure, following the loss of containment event. The information gathered is used to enable further source control planning and establish source control activities that can be implemented. A single vessel and/or aircraft is required to conduct the site survey. Multiple vessels and/or aircraft would not result in a better environmental outcome. If the failure can be immediately isolated remotely then this is the quickest response to reduce the environmental impact.	Additional vessels equipped with ROV's would not result in increased benefit for planning source control activities.	A suitable vessel or aircraft will be sourced by Shell during the timeframe stipulated in the BROPEP. The vessel/aircraft to undertake the site survey would be sourced from within Australia using Shell's established contracting procedures. Shell has third-party call off contracts for helicopters and fixed wing aircraft. These aircraft can be ready for mobilisation in 4–8 hours. The cost of maintaining a vessel (with full crew) or having aircraft on standby at all times to undertake a site survey is considered to be grossly disproportionate to the benefits given that suitable vessels and/or aircraft could be made available on short notice within the region. The prelude wells have multiple types of subsea tree fail-safe closed valves. With the subsea tree still connected, if there is a leak then the initial response would be to attempt to isolate the failure by remotely functioning one or more valves from the facility. There is also some ROV intervention capability.

Oil Spill Response Strategy	Resources	Environmental gain from increasing or improving resources	Alternatives considered	ALARP assessment
Deployment of SFRT/SIRT and subsea dispersant injection (SSDI)	**Documents:** • East Browse Basin Source Control Emergency Response Plan • Source Control Equipment Mobilisation Plan **Equipment:** • AMOSC Subsea First Response Toolkit (SFRT) including 500 m^3 of Dasic Slickgone NS, mobilised to Broome in 6 days. • OSRL Subsea Incident Response Toolkit (SIRT) mobilised to Broome. **Personnel:** • Subsea Intervention Group/Source Control Branch, Shell's Well Control Virtual Emergency Response Team (WC VERT) available in 24 hours. • AMOSC (SFRT) and Oceaneering (SIRT) personnel are available 24 hours.	Access to the SFRT/SIRT to enable intervention in the event of a loss of well control scenario will also enable SSDI capability. SSDI will increase the entrainment of hydrocarbons in the water column thereby reducing the presence of hydrocarbons at the sea surface that can present environmental impacts from a LOWC. For a Prelude LOWC SSDI would only be used to reduce volatile organic compounds at the sea surface making it safer for responders to access the area for further source control activities. The duration for such SSDI activities would be in the order of 1-2 days total duration. Whilst not expected to be utilized, the volume of dispersant associated with the SFRT can be replenished from various stockpiles located within Australia and Internationally.	Consideration was given to moving the AMOSC SFRT to Broome to from Perth to enable for faster deployment however, it is owned by industry (others may also need the equipment in other areas) and as it is not on critical path there is little value to be gained by such.	Based on its location in WA, the AMOSC SFRT (located in Perth) would be mobilised as the primary control with the SIRT located in Norway/Brazil as a redundancy. Vessels equipped to undertake the site survey are expected to take approximately 7-10 days to mobilise therefore the timeframe for mobilisation of the SFRT is not a limiting factor and improving this timeframe would not result in an environmental benefit.
Relief well drilling (primary containment method)	**Documents:** • Prelude WOMP. • Prelude Safety Case.	Improving the timeframes to drill a relief will reduce the volume of hydrocarbons released to the marine environment.	The relief well injection spool (RWIS) is a spool piece with side outlets installed below the Blowout Preventers (BOP) of the	Compliance with Shell's global standards for well design integrity to assure mechanical and functional integrity for all anticipated loads

Oil Spill Response Strategy	Resources	Environmental gain from increasing or improving resources	Alternatives considered	ALARP assessment
	• East Browse Basin Source Control Emergency Response Plan Relief Well Manual. • Well Kill Modelling & Analysis. • APPEA MoU. **Equipment:** • Mobile offshore drilling unit (MODU) to drill a relief well and kill the well in 80 days, kill fluid & pumping equipment, tubulars, ranging equipment. **Personnel:** • Shell Relief Well Task Force with a response time of 24–72 hours. • Specialist personnel from Wild Well Control and Boots and Coots. Specialists are located at various international locations with a response time of +72 hours.		relief well to enable the connection of more surface pumping resources. These additional resources can deliver greater kill fluid rates to the relief well. As all Prelude wells can be killed with the pumping capacity of standard MODU, use of the RWIS would not result in a faster well kill and subsequent environmental benefit.	throughout the life of the well. These standards meet or exceed current International and Australian standards. The APPEA MoU allows the signatories to share rigs, equipment, personnel and services to assist other operators in the event of a well blowout. This would potentially enable Shell to source a suitable relief well MODU in a quicker timeframe, and would also provide access to additional equipment, personnel and services. Access to source control specialists is not considered a limiting factor.
Surveillance, Modelling and Visualisation				
Modelling (oil spill trajectory, fate & weathering, met ocean data, satellite imagery)	**Processes:** • AMOSC call-off procedure **Equipment:**	Oil spill trajectory modelling can be commenced using AMOSC call off contract with RPS group within 2 hours of IMT being notified of the spill. The data would be used to inform Incident Action Plans (IAPs) and confirm the selection of	N/A	No alternative or additional controls have been identified that could improve this response.

Oil Spill Response Strategy	Resources	Environmental gain from increasing or improving resources	Alternatives considered	ALARP assessment
	• Automated Data Inquiry for Oil Spills (ADIOS2) on IMT computers • In-house deterministic modelling **Personnel:** • Shell Geomatics team	other response strategies in the following days. Therefore, there is no environmental gain in improving the activation timeframe.		
Surveillance - vessel	**Processes:** • N/A **Equipment:** • FLNG support vessels **Personnel:** • Trained vessel crew	Several support vessels will be present in WA-44-L. Shell has a contract with marine vessel contractors to provide additional vessels for oil spill response activities if required. There is no environmental gain from providing additional vessels.	N/A	Increasing vessel surveillance capability is not considered to be warranted based on the limitations associated with visual observations made from a vessel platform. Aerial surveillance in conjunction with deployment of tracking buoys is a more effective method of obtaining situational awareness. Vessel surveillance can be undertaken through the use of existing FLNG support vessels.
Surveillance - aerial	**Processes:** • Third party call-off contract • Aerial surveillance observation log **Equipment:** • N/A **Personnel:** • Trained aerial observers (AMOSC/AMSA/OSRL)	Shell has third-party call off contracts for helicopters and fixed wing aircraft. These aircraft can be ready for mobilisation in 4-8 hours. Trained aerial observers are available within 24 hours.	Personnel trained in aerial observation could be on standby in order to provide higher quality data to the IMT. However, in the first 24 hours the spill it is likely to cover a relatively small geographical location close to the release point. Therefore, initial untrained observations are considered to be adequate given the other data available to the	Untrained aerial observation opportunities exist via Shell crew change helicopters. This in conjunction with tracking buoys and other surveillance, modelling and visualisations data is expected to provide sufficient information for the IMT in the first 24 hours, until such time as trained aerial observers are available. There is also the opportunity to use crew change helicopters from INPEX operations within close

Oil Spill Response Strategy	Resources	Environmental gain from increasing or improving resources	Alternatives considered	ALARP assessment
			IMT such as spill modelling, tracker buoy data etc.	proximity to the Crux-Prelude field of operations for further observation.
Tracking buoys	**Processes:** • N/A **Equipment:** • East Browse Basin Source Control Emergency Response Plan **Personnel:** • East Browse Basin Source Control Emergency Response Plan	Tracker buoys are available for immediate deployment from a variety of locations including the Prelude FLNG facility. No environmental benefits can be gained by increasing the number of buoys available or time to deploy.	Access to additional buoys is available from the shared stockpile located in Broome.	No alternative or additional controls have been identified that could improve this response.
Surface Chemical Dispersant				
Vessel based Dispersant application	**Processes:** • Shell Surface Dispersant Application Guide **Equipment:** • 5 m3 Dasic Slickgone and AFEDO spray set on each ISV (3 vessels in field or en-route) **Personnel:** • Vessel personnel trained in vessel application techniques	Based on the existing capability, Shell could commence vessel based dispersant application immediately subject to AMSA approval (where relevant). Additional supplies of dispersant can be obtained from stockpiles on the Australian mainland.	N/A	In the event of a spill that was amenable, surface application of dispersant from vessels can be implemented immediately upon approval. In the event that additional stockpiles of dispersant are required they can be accessed from stockpiles in various locations across Australia.
Fixed Wing Aerial Dispersant (FWAD) application	**Processes:** • Shell Surface Dispersant Application Guide.	Pre-positioning of aircraft and personnel (air attack supervisor) in particular could enable a faster response time resulting in	Additional costs associated with pre-positioning aircraft and personnel are estimated to be in	The effectiveness of this response strategy is affected by sea state conditions and the thickness of oil at

Oil Spill Response Strategy	Resources	Environmental gain from increasing or improving resources	Alternatives considered	ALARP assessment
	AMOSC/OSRL call-off procedure. **Equipment:** • N/A **Personnel:** • Air attack supervisors and pilots.	quicker application of dispersant with more oil treated and hence an overall environmental benefit.	the order of 10s of thousands of dollars per day and are considered to be grossly disproportionate given the access to vessel-based dispersant application.	the sea surface; therefore it may only be applicable to the HFO spill scenario. Shell has access to AMSA fixed wing aircraft wheels up in 4 hours and first implementation within 36 hours with supporting monitoring aircraft. Surface application of dispersant using vessels can be implemented much faster and therefore the costs associated with increasing FWAD capability are considered to be grossly disproportionate given the risk.
Contain and Recover				
Containment and recovery equipment (offshore boom and skimmer system)	**Processes:** • Shell Offshore Contain and Recover Guide. **Equipment:** • FLNG support vessels AMOSC stockpile (Broome) 400 m of offshore boom and skimmer system. • Waste storage capability **Personnel:** • AMOSC/AMSA/OSRL trained and experienced personnel.	Increasing a contain and recover response will results in the removal of more oil from the sea surface and therefore less will accumulate on shorelines resulting in less environmental impacts to shoreline receptors and less waste generation.	Additional dedicated vessels with offshore boom and skimmer systems would cost in the order of 10s of thousands of dollars per day and is not considered warranted given the availability of such equipment is not a limiting factor in the effectiveness of this strategy.	Shell has access to the AMOSC stockpile located at Broome (and other stockpiles elsewhere in Australia). The effectiveness of this response strategy is affected by sea state conditions and the thickness of oil at the sea surface; therefore it may only be applicable to the HFO spill scenario. Maintaining booms and skimmers offshore is not practicable due to space limitations. The availability of contain and recover equipment is not a limiting factor and other response strategies could be implemented in faster timeframes (vessel-based dispersant) that would be more effective on HFO spills.
Shoreline Protection and Deflection				

Oil Spill Response Strategy	Resources	Environmental gain from increasing or improving resources	Alternatives considered	ALARP assessment
Shoreline and nearshore booming equipment	**Processes:** • Browse Island Oil Spill Incident Management Guide **Equipment:** • AMOSC/OSRL specialised equipment **Personnel:** • AMOSC/OSRL trained and experienced personnel.	Shoreline assessment specialised personnel can be deployed to remote shorelines from staging/accommodation facilities within 5–6 days. Undertaking quicker shoreline assessment would be beneficial to obtain pre-impact results, however, shorelines in the Browse Basin are difficult to access due to their remoteness and safety risk. Earlier deployment may not result in an overall environmental gain.	N/A	Shoreline surveys must be conducted systematically to be a crucial component of effective decision-making. Repeated surveys are needed to monitor the effectiveness of ongoing treatment methods (i.e. changes in shoreline oiling conditions, as well as natural recovery). Improving the time for specialised personnel to access remote shorelines to make assessments is not warranted and will not result in an environmental gain. Noting that the decision to commence this strategy may be made by WA DoT as the Control Agency.
Shoreline Clean-up				
Shoreline Clean-up Assessment	**Processes:** • Shoreline Clean-Up Assessment Operational Monitoring Plan (OMP) (refer to the Browse Regional OSMP (HSE_PRE_016370). • Browse Island Incident Management Guide. • Helicopter call-off contract **Equipment**: • Staging and accommodation facility **Personnel:**	Shoreline assessment specialised personnel can be deployed to remote shorelines from staging/accommodation facilities within 5-6 days. Undertaking quicker shoreline assessment would be beneficial to obtain pre-impact results, however, shorelines in the Browse Basin are difficult to access due to their remoteness and safety risks. Earlier deployment may not result in an overall environmental gain.	N/A	Shoreline surveys must be conducted systematically to be a crucial component of effective decision-making. Repeated surveys are needed to monitor the effectiveness and effects of ongoing treatment methods (i.e. changes in shoreline oiling conditions, as well as natural recovery). Improving the time for specialised personnel to access remote shorelines to make assessments is not warranted and will not result in an environmental gain. Noting that the decision to commence this strategy may be made by WA DoT as the Control Agency.

Oil Spill Response Strategy	Resources	Environmental gain from increasing or improving resources	Alternatives considered	ALARP assessment
	• AMOSC/OSRL trained and experienced personnel.			
Manual and mechanical removal (washing, flooding & flushing, sediment reworking & surf washing)	**Processes:** • Shoreline Clean-Up Assessment OMP. • Browse Island Incident Management Guide. **Equipment:** • AMOSC/OSRL specialised equipment. **Personnel:** • AMOSC/OSRL trained and experienced personnel.	Predictive oil spill modelling indicates the largest volumes accumulating on shorelines is 804 m^3 of HFO at Ashmore Reef AMP. Depending on the sensitivity of the shoreline removal of accumulated oil using heavy machinery and/or large numbers of personnel may result in additional environmental damage. Access by heavy machinery would also be restricted at offshore islands.	Costs for additional clean-up equipment are considered to be negligible and are not considered a limiting factor in the effectiveness of this strategy. Constraints primarily lie in mobilising equipment and personnel safely rather than sourcing additional equipment.	Shell has access to shoreline response kits. Given the logistical and safety limitations with shoreline response in the Browse Basin, implementation of the response will take approximately 1 week to occur from decision being made to commence (noting that this decision may be made by WA DoT as the Control Agency within State waters). Large scale operations involving large numbers of personnel and/or heavy equipment may cause adverse environmental impacts at many of these sensitive shoreline locations and would not result in an environmental gain. Manual clean-up equipment, using smaller teams for longer periods would be more effective in most of the shoreline locations predicted to be contacted.
Oiled Wildlife Response				
Oiled wildlife response implementation	**Processes:** • WA Oiled Wildlife Response Plan (WAOWRP)/NT Oiled	Given access to local OWR equipment and personnel (AMOSC) through existing arrangements the response capability cannot be improved to result in an environmental gain unless an OWR kit is maintained offshore.	Any OWR will be undertaken in consultation with the relevant agencies e.g. WA DBCA, WA DoT and NT Department of Environment, Parks and Water Security (DEPWS). Such	Shell is a participating member of AMOSC with access to Mutual aid arrangements. AMSA MoU and OSRL contracts, enabling access to national and international oiled wildlife expertise. The closest OWR container

Oil Spill Response Strategy	Resources	Environmental gain from increasing or improving resources	Alternatives considered	ALARP assessment
	Wildlife Response Plan (NTOWRP) **Equipment:** • AMOSC Oiled Wildlife Response (OWR) containers (2) and box kits. NatPlan, OWR containers (4), OSRL OWR equipment. **Personnel:** • AMOSC/OSRL trained and experienced national and international OWR personnel.		consultation is more likely to be a time limiting factor than accessing additional OWR resources.	is located in Fremantle and can be mobilised to Broome within ~30-60 hours by vessel. Additional containers and box kits are available from other locations within Australia (including Broome for the closest box kit). Maintaining a dedicated OWR kit offshore is not considered to be reasonable given the low likelihood of needing to implement an OWR and the requirement for trained OWR personnel.
Waste Management				
Waste management	**Processes:** • Oil Spill Waste Management Plan Template. **Equipment:** • Assorted waste receptacles and trucks from waste contractor with additional stocks from sub-contractors located in Darwin, Broome and/or Dampier. • 635 m^3 capacity of offshore storage in Darwin. **Personnel:**	There are no limitations to obtaining the required waste storage capacity for this EP and no environmental benefit obtained by accessing additional waste storage capacity.	Costs for additional waste management resources are considered to be negligible.	Based on the BROPEP, the volume of waste generated by the worst-case spill is up to 5,500 m^3. Decanting from contain and recover operations will also generate waste for disposal (if and where practical). Typically, this oily liquid waste would be held within the inboard storage tanks of the vessels and disposed at a licensed onshore facility. Based on Shell's waste contractor capability the available resources are considered to be suitable for the worst-case spill scenario.

Oil Spill Response Strategy	Resources	Environmental gain from increasing or improving resources	Alternatives considered	ALARP assessment
	• Waste contractor personnel.			

9.15.2 Aspect Context

This section describes any new or unique environmental impacts or risks presented by implementing the emergency events response strategies included in the BROPEP (HSE_GEN_016765), which may be enacted to respond to hydrocarbon spills as described in Section 9.14.1.6.

Typically, environmental aspects, impacts and risks that arise from conducting the emergency response activities are similar to those already described in Section 9 for the planned and unplanned activities, particularly for vessel-based operations. Where additional impacts or risks exist for the identified aspects, these are described in the following subsection. Table 9-127 summarises the aspects generated by implementing the spill response activities and identifies any that are new or unique aspects for further assessment. If impacts and risks are adequately addressed in the preceding sections of this EP, as indicated in Table 9-127, they are not discussed further in this section.

As can be seen in Table 9-127 several response strategies which could be used from a Prelude worst case scenario introduce aspects that require further assessment. Additional context on these response activities is provided in Section 9.15.3.

Table 9-127: Spill Response Strategies and Associated Environmental Aspects Identified for Each (Including Those Considered New or Unique)

		Aspects Generated												
		Physical Presence	**Lighting[2]**	**Noise**	**Seabed Disturbance**	**Disturbance to Ground[1]**	**Vessel movements**	**Introduction of Invasive Marine Species**	**Produced Water**	**Activity Discharges**	**Atmospheric Emissions**	**Greenhouse Gas Emissions**	**Minor Releases and Waste**	**Emergency Events**
Response Strategies	Source Control (Including SSDI)[3]	✓	✓	✓	✓		✓	✓	✓	×	✓	✓	✓	✓
	Surveillance, Modelling and Visualisation	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓
	Natural Recovery													
	Chemical Dispersant (Surface)	✓		✓			✓	✓		×	✓	✓	✓	✓
	Containment and Recover	✓		✓	✓		✓	✓	✓	✓	✓	✓	×	✓
	Protection of Sensitive Resources	✓		✓		×	✓	✓	✓	✓	✓	✓	✓	✓
	SCAT and Shoreline Clean-up		×			×				✓	✓	✓	✓	
	Oiled Wildlife Response	✓		✓				✓	✓	✓	✓	✓	✓	✓
	Operational and Scientific Monitoring	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓

Notes:

✓ The aspects and associated impacts and risks are already adequately addressed in this EP (Section 9).

× There is an aspect of the response activity that may produce a new or unique impact/risk not already addressed in this EP.

1 New or different aspect not previously described in this EP.

2 Due to daylight operations only for typical vessel-based activities, lighting impacts for stationary, non-operating vessels at sea during night will not present a credible impact to sensitive receptors.

3 As described further in the BROPEP, source control activities to respond to a LOWC emergency event may include drilling a relief well. All source control activities will be managed in accordance with the accepted BROPEP, Safety Case and WOMP.

9.15.2.1 Subsea Source Control and SSDI

Relief well drilling will be the primary means of source control. As further described in Section9.14.1.1 the current configuration of the Prelude production wells with subsea Xmas trees installed and connected to subsea flowlines negate the use of a capping strategy.

9.15.2.1.1 Chemical Dispersant Subsea (SSDI)

SSDI would only be a viable response strategy for a LOC of Prelude condensate from subsea infrastructure. Dispersants are applied to hydrocarbon spills to enhance the breakdown of hydrocarbon droplets and enhance dispersion into the water column. This strategy is typically used when large volumes of floating oil are expected. It helps break up oil droplets before they reach the surface, increasing the volume of hydrocarbons mixed into the water column. As a result, it reduces the risk of exposure to seabirds, surfacing marine animals, and coastal areas. The worst case modelled subsea release of condensate does not predict floating oil above 10 g/m^2 at any point in the modelling (see Section 9.14.1.12.1). SSDI would therefore not be used to reduce environment impact, but as part of the overall source control strategy to ensure conditions are safe for responders (i.e. minimise gas cloud concentration and extent). The use of chemical dispersants may result in impact to the environment from the dispersant chemical, and oil/dispersant mix in the water column. Refer to the BROPEP for further details.

9.15.2.1.2 Relief Well Drilling

The Prelude relief wells are designed in accordance with Shell's Relief Well Manual and East Browse Basin Source Control Emergency Response Plan.

Relief Well Locations

Surface locations for relief wells in the Prelude field cannot be precisely defined, principally because of the varying wind, wave and current directions affecting the planned locations different times of the year. The Prelude field area has been assessed for seabed and shallow hazards that might influence the choice of relief well surface locations. To allow maximum flexibility, a relief well surface location has been identified in each quadrant at equal separation from the blowout well (Table 9-128). Given the Prelude Development wells are within circa 100 m from each other, this approach is representative for the other wells.

Table 9-128: Generic Prelude relief well surface locations across 4 quadrants (N, E, S, W)

Name	Target	Northing (GDA94)	Easting (GDA94)	Latitude	Longitude
Relief Well #4 (North)	P1	8473256.49	535355.32	13° 48' 36.195 S	123° 19' 37.645 E
Relief Well #1 (East)	P1	8472494.78	536117.03	13° 49' 0.956 S	123° 20' 3.051 E
Relief Well #2 (South)	P1	8471733.07	535355.32	13° 49' 25.784 S	123° 19' 37.714 E
Relief Well #3 (West)	P1	8472494.78	534593.61	13° 49' 1.023 S	123° 19' 12.307 E

Relief Well Design Criteria

The criteria below were adopted to define the relief well trajectories for planning purposes, as described in the East Browse Basin Source Control Emergency Response Plan. Actual relief well trajectories may be adjusted as deemed necessary.

- Kick-off point below the base of the Grebe formation at circa 1,370 m measured depth (MD).
- Inclination constrained to 30° before and at initial bypass/ranging point.
- Beyond the bypass point, trajectory parallels the blowing well and inclination builds from tangent 30° to circa 78° at the 9-5/8" shoe (target wells are highly deviated). Triangulation should be performed after a "cross-by" to minimize the total positional and ranging uncertainties.

- The initial homing/ranging point lies along the length of the 9-5/8" casing, at circa 3,250 m MD. This offset from the final intersect allows for multiple bypasses and aligning the relief well correctly without the need for a sidetrack.
- A safe and close proximity is used to parallel the target well trajectory after the by-pass. A radial distance to the target well of <7 m should give accurate ranging results and facilitate drilling parallel to the target well trajectory.
- At the bottom of the relief well the dogleg severities exceed the recommended 1.5°/30 m, because the target well has doglegs of ~2.5°/30 m at the depth of the intersect.
- The last casing string in the relief well (9-5/8" casing shoe) should be set in the lower Echuca Shoals formation (competent formation).
- The intersection point will be the 7" liner immediately below 9-5/8" casing at circa 4,480 m MD. RA tags are installed on the 9-5/8" casing on all the wells. This promotes tracking the well and establishing accurate depth correlation. The preferred way to intersect the blowout well would be using a concave mill bit. Alternatively, perforation using perforating guns may be opted for.

Relief Well Design & Inventory

The relief well design follows the Shell Casing and Tubing Design Manual requirements. The relief well configuration follows a similar design rationale as the Prelude Development wells:

- Conductor (circa 330 m mean depth/true vertical depth): provides structural support for the installation of the inner conductor and provides structural and fatigue integrity for the well. The low-pressure housing is welded to the first conductor joint.
- Inner conductor (circa 612 m MD/TVD): provides structural and fatigue integrity of the well, including all subsequent casing strings and the weight of the Blowout Preventer (BOP).
- Surface casing (circa 2,360 m MD/ 2,355 m TVD): provides pressure integrity when drilling the subsequent 12-1/4" section with BOP installed. The high-pressure wellhead housing is likely to be welded to a 20" or 22" extension joint and swedged to 13-3/8" casing (or similar).
- Intermediate casing (circa 4,400 m MD/ 4,000 m TVD): The last casing set prior to drilling the intersect section. This string is designed to withstand all loads associated with the dynamic kill. On the Prelude development a tapered 10-3/4" x 9-5/8" casing is used. For relief well example, the 9 ⅝" production casing is set circa 10 m TVD shallower than the target well.
- Wellhead system: A UWD-15 or LB2M wellhead system as respectively used on Prelude and Crux Development wells would allow delivery of the above well configuration.

Prelude will primarily rely on the bespoke Crux relief well inventory to respond to a source control event on Prelude. It has been demonstrated that the Crux material grades are compatible with the reservoir environment at Prelude and can be used to support relief well drilling operations on Prelude. The minimum relief well equipment inventory is shown below in Table 9-129.

Table 9-129: Minimum Relief Well Equipment Inventory

String	Quantity
36″ 553 ppf 1.5″ WT X65-M Viper-3ST M95 or similar	2 jts
36″ 553 ppf 1.0″ WT X65-M Viper-3ST M95 or similar	2 jts
36″ 553 ppf 1.0″ WT X65-M Viper-3ST M95 shoe joint or similar	1 jts
26″ 202 ppf 0.75″ WT X70-M Viper-3ST M95 or similar	350 m
26″ 202 ppf 0.75″ WT X70-M Viper-3ST M95 shoe joint or similar	1 jts
13⅜″ 72 ppf P110 VAM21 or similar	2213 m
10¾″ 65.7 ppf L80 VAM21 or similar	600 m
9⅝″ 53.5 ppf Q125R VAM21 or similar	4050 m

String	Quantity
Wellhead	**Quantity**
LB-2M Low-pressure wellhead housing	1 x
LB-2M 15ksi High-pressure wellhead housing	1 x
LB2M Low-pressure wellhead housing	1 x
LB2M 15ksi High-pressure wellhead housing	1 x

Well Kill Modelling Summary

Dynamic well kill simulations are documented in the East Browse Basin Source Control Emergency Response Plan, confirming the Prelude wells can be killed with a single relief well.

Relief Well Drilling Rig Specifications

Relief well drilling rig specifications are capture within the Prelude Well Control Contingency Plan, with key specifications summarised in Table 9-130.

Table 9-130: Relief Well Drilling Rig Specifications

Specification	Value
Water depth rating	>237 m
Station keeping	Anchor moored or DP
BOP rating	10,000 psi or more
Fluid storage capacity	3,000 – 6,000 bbls (Min. 3,000 bbls)
Mud pump system	4x 14-P-220 NOV triplex or similar mud pumps
Cement unit	>2,000 HP
Choke & kill lines	3 1/16” or more
Hookload	Circa 1,500,000 lbf
Max drilling depth	Min. circa 4,500 m MD (Deepest planned intersect point)

Relief Well Drilling Rig Sourcing

Shell is a signatory to an Australian Energy Producers (AEP) memorandum of understanding 2022 (MoU) between Australian offshore operators to provide mutual aid to facilitate and expedite mobilising a MODU and drilling a relief well in the event of a loss of well control incident. The MoU enables the signatories to share rigs, equipment, personnel and service to assist another operator in need.

MODU availability is tracked on a monthly basis. Shell has access to Clarksons Sea/response software platform through its OSRL membership. The software uses its patented technology to identify emergency vessels, rigs and equipment most suitable for source control operations and those that are closest to the incident location.

Sea/response real-time vessel tracking has been set up to search vessels on pre-identified mission requirements covering Capping, Containment and Offset Installation Equipment (OIE). Vessels that already have an approved Safety Case for working in Australia are tracked.

Shell Australia has arrangements in place for specialist assistance to help with engineering and operational support for relief well planning and execution. Shell has Global Framework Agreements (GFA) in place with the two preferred tertiary well control contractors Wild Well Control and Haliburton Boots & Coots. In turn, Shell Australia has local contracts with both providers to allow a rapid call-off.

The scope of services covered by these contracts includes but is not limited to:

- Emergency response services involving all activities necessary to establish control over a blowing well.
- Well control management services involving the integration of the well control contractor into the Source Control Branch for effective and harmonised levels of communication and control.
- Routine engineering services and contingency planning.
- Training of personnel.
- Developing well intervention methods.
- Modelling the reservoir including inflow performance and kill rate requirements.
- Firefighting, including well capping, snubbing, freezing, hot tapping and valve drilling.
- Relief well planning and drilling, pumping services.
- Environmental clean-up services.

Directional drilling and ranging services can be provided under the existing local Shell Australia Well Services Contract. Alternatively, ranging services can also be provided by Haliburton under the Boots and Coot GFA. Similarly, well kill modelling services are available under the above services can also be provided through the existing Well Services Contract with Schlumberger who have provided relief well planning services for Shell in 2022.

Relief Well Drilling Response Time Model

It is estimated a suitable MODU could reach the well location and kill the well within 80 days (Table 9-131). A detailed response time model with key milestones in line with APPEA Source Control Guidelines is presented in the table below for MODUs active in Australian Waters. Non-drilling performance specific durations follow the recommendations within the Australian Offshore Titleholders Source Control Guideline (APPEA 2021). Drilling timings benchmark with industry data and follow Operator historical Trouble Free Time and Non Productive Time offset drilling performance trends.

Table 9-131: Relief Well Drilling and Well Kill Duration

Phase	Task/Milestone	Duration (day(s))
Activation (7 days)	• Event reported. • Begin sourcing of relief well rig. • Concurrently begin activation of source control team and source control specialists.	1
	• Relief well rig confirmed. • Relief well MODU mobilisation to relief well location. • Concurrently, commence preparation of relief well MODU Safety Case Revision. • Concurrently, commence preparation of relief well WOMP.	6
Transit (21 days)	• Relief well MODU contract confirmed. • Finalise preparations for mobilisation to relief well location.	3
	• Mobilise rig to relief well location.	18
Drilling & Well kill (52 days)	• Relief well MODU Safety Case Revision and WOMP approved by NOPSEMA. • Commence preparations for spud. • Commence mobilisation of equipment to relief well MODU.	3

Phase	Task/Milestone	Duration (day(s))
	• Commence relief well drilling operations to intercept and kill the well. • Continue mobilisation of equipment and personnel required to kill the well. • Finalise well kit preparations and conduct well kill.	49

9.15.2.2 Chemical Dispersant (surface)

Chemical surface dispersant spraying would likely only be used in a worst case HFO release where surface hydrocarbons are at an effective thickness. Refer to the BROPEP for further details. The use of chemical dispersants may result in impact to the environment from the dispersant chemical, and oil/dispersant mix in the water column.

9.15.2.3 Containment and Recovery – Decanting Operations

Application of the Contain and Recover strategy is significantly limited by weather, logistics, and requires substantial temporary waste storage for recovered hydrocarbons. Containment and recovery relies on surface thickness of hydrocarbons, therefore would not be effective for Prelude LOWC condensate scenarios, where surface hydrocarbons are not predicted. Recovered hydrocarbons will inevitably contain a large proportion of water in addition to recovered oil that may need to be decanted back to the sea to optimise the recovered oil fraction. Refer to the BROPEP for further details.

9.15.2.4 Shoreline Clean-up and Protect and Deflect – Disturbance to Ground

Conducting shoreline protection and clean-up involves moving personnel and equipment, which includes the environmental aspect of ground disturbance and (possibly) local lighting. The objective of shoreline clean-up is to apply clean-up techniques that are appropriate to the shoreline type to remove as much oil as possible where there is a net environmental benefit in doing so. Various techniques may be used alone or in combination to clean up oiled shorelines, including shoreline clean-up assessment techniques, natural recovery, absorbents, sediment reworking, manual and mechanical removal, and washing, flooding, and flushing. Considerations for selecting and implementing shoreline clean-up techniques are included in the BROPEP.

Deploying booms to protect sensitive shoreline receptors, typically pre-emptively, introduces the potential for ground disturbance or damage to nearshore habitats such as intertidal reefs, seagrasses and macroalgal communities that are present at offshore islands/shorelines.

Due to the remote locations at which these response activities may be undertaken, and associated logistic and safety considerations, it is very unlikely that nighttime operations would be conducted. If they were required, the associated lighting would involve mobile, low elevation sources with limited potential for light affects beyond the area of activity.

9.15.3 Description and Evaluation of Impacts

Table 9-132 indicates the environmental features, values and sensitivities that have been identified to be potentially affected by the oil spill response strategies in the event of an emergency event during the activities covered by this EP. Features or values and sensitivities which could not be credibly affected by oil spill response strategies are not discussed further.

Table 9-132: Oil Spill Response Strategies Receptor Impact Screening Summary

	Protected Areas			Features															Values and Sensitivities																							
				Physical		Natural				Socioeconomic								Heritage and Cultural			Physical				Natural								Socioeconomic							Heritage and Cultural		
Receptor	Marine Conservation Reserves	Wetlands of International and National Importance	Commonwealth and National Heritage Places	Marine Regions	Australian Environment	Northwest Shelf Province Bioregion	Northwest Shelf Transition Bioregion	Northwest Transition Bioregion	Timor Province Bioregion	People and Communities	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Connections	Air Quality	Water Quality	Sediment Quality	Underwater Noise	BIAs	Critical Habitat	Shoals and Banks	Offshore Reefs and Islands	Coastal Reefs and Islands	KEFs	Threatened, Migratory, Marine and Cetacean Species	Fishing Industry	Tourism and Recreation	Defence	Shipping	Scientific Research/Restoration	Oil and Gas Industry	Indonesian and Timor-Leste Coastlines	Underwater Cultural Heritage	Traditional Indonesian Fishing	Indigenous Cultural Heritage
Aspect	×			×					×													×	×					×			×										

Legend:		
		Potentially affected
	×	Predicted impact

9.15.3.1 Relief Well Drilling – Planned Chemical Discharges

Drilling of a relief well in response to a LOWC at Prelude will result in additional/different activity discharges to sea from those described in Section 9.10, notably cuttings and drilling fluids. Associated environmental effects include localised disturbance to seabed sediments and associated benthic communities, and a localised and temporary reduction in water quality. All of the pre-selected relief well drilling locations are in deep (~230 m) water, ~62 km from the nearest known banks or shoals and where the seafloor is expected to comprise predominantly bare unconsolidated substrates. The discharges associated with the drilling of relief wells are summarised below.

9.15.3.1.1 Physical Features, Values and Sensitivities

Water and Sediment Quality

Impacts to water quality from the discharge of drilling fluids and cuttings typically occur within close proximity of the discharge point. This is supported by results from the recent modelling of drill cuttings and fluids discharges that was conducted for the Crux foundation wells ~160 km from Prelude, which indicated dilution is expected to occur rapidly due to the currents in the open ocean environment (RPS 2018a). Very fine cuttings form a very small portion of the total amount of cuttings and fluids discharges as they tend to clump together to form larger particles that sink relatively quickly. The combination of low toxicity and rapid dilution of unrecoverable drilling fluids discharged in association with drill cuttings are of little risk of direct toxicity to water-column biota (Neff et al. 2000).

The majority of drill cuttings and residual fluids will be deposited in the area around the discharge location and will form a cuttings pile. The accumulation of cuttings will physically modify the sediments by modifying the particle size distribution. Crux Stochastic modelling results indicated that the cuttings pile may reach a thickness of up to 374 mm for a single well (RPS 2018a), which will be largely comprised of coarse cuttings directly under the discharge location. Impacts to sediment will decline with increasing distance from the wells.

The coarser sediments deposited directly under the discharge location are unlikely to be resuspended by currents and will gradually be buried by naturally deposited sediments over time. Finer sediments deposited further away may be reworked by currents and transported via saltation or as suspended sediments.

Based on the assessment, potential impacts to physical features, values and sensitivities from the discharge of drill cuttings and fluids are considered to be Minor, with no long-term effects anticipated (Magnitude: −2, Sensitivity: L).

9.15.3.1.2 Natural Features, Values and Sensitivities

Timor Province Bioregion

Benthic Communities

The discharge of drill cuttings and residual fluids will impact upon benthic communities due to the potential physical and chemical changes to sediments. The deposition of cuttings has the potential to smother sessile benthic organisms, with effects predicted to occur at deposition thicknesses of greater than 6.5 mm (IOGP 2016). Sedimentation is an ongoing natural process, and benthic organisms exhibit adaptations to respond to increased sediment deposition. Natural sedimentation rates in northwest Australia were estimated by Glenn (2004) to range between ~0.17 mm and 2.23 mm per year.

Benthic communities in deeper waters, such as those found within the majority of the Planning Area, are generally expected to be less abundant and diverse. These communities are further described in Section 7.7.8. These are widely represented in the region and are not of high environmental value. Modelling studies conducted for Crux drilling (RPS 2018a) indicate that communities will be affected by the discharge of drill cuttings and fluids out to a range of ~326 m from the discharge point (e.g. some reduction in species diversity and abundance). High levels (>10 mm) of burial will occur out to a radius of ~68 m; sessile benthic fauna within this range are expected to be completely smothered.

The relief well drilling locations are not close to any sensitive or high conservation value benthic habitats. The absence of benthic primary producers in this environment and the relatively short duration of the discharge limits the potential for impacts upon benthic communities. Given this, impacts are expected to be Minor, with no long-term effects anticipated (Magnitude: −2, Sensitivity: L).

Pelagic Communities

Adverse effects on pelagic species, including planktonic communities, may occur due to a change in water quality following discharges of drill cuttings and fluids. Impacts to these organisms can be as a product of both physical and chemical alterations of water quality predominantly in the water column.

Studies by Smit et al. (2008) indicated that phytoplankton and filter-feeding zooplankton typically exhibit greater effects from suspended solids from drilling and suggested that these biota are less well-adapted to relatively high concentrations of suspended sediments than benthic biota. Concentrations at which impacts to phytoplankton may result are highly localised and unlikely to occur >25 m from the discharge point (IOGP 2016; Smith et al. 2004). Studies indicate effects of drilling fluids and cuttings on zooplankton at concentrations >100 mg/L are unlikely, based on 96-hr exposure duration experiments. Concentrations >100 mg/L for more than 96 hours during relief well drilling activities would only occur in the immediate vicinity of the discharge location. Minimal impact to plankton (phytoplankton, zooplankton and meroplankton (larvae of invertebrates and fish) is therefore expected from the discharge of drill cuttings.

The localised, temporary decrease in water quality from the discharge of drill cuttings and fluids may temporarily displace pelagic marine fauna from the plume; this short- term, behavioural impact is considered to be negligible. Neff (2010) explains that the lack of toxicity and low bioaccumulation potential of the drilling muds means that the effects of the discharges are highly localised and are not expected to spread through the food web.

Given the open ocean location of the relief well sites and associated environmental conditions (i.e. windy, strong currents, etc.), the content and dispersive nature of drilling muds within the marine environment, and the small proportion of any pelagic species population that may be affected by localised and temporary impacts to water quality, the impacts to pelagic communities from drilling discharges are considered to be Slight (Magnitude: −1, Sensitivity: L).

Threatened, Migratory, Marine and Cetacean Species

There are no aggregation areas for EPBC Act listed species within the areas potentially affected by drilling discharges. The benthic habitats in the vicinity of the relief well locations are unlikely to support substantive foraging or other important lifecycle activities in any species. Many of the threatened, migratory, marine and cetacean species potentially exposed to discharges (e.g. cetaceans, marine turtles) are air-breathing vertebrates which are unlikely to be directly affected as their skin is relatively impermeable. Given the localised and temporary nature of effects to water quality as a result of drilling discharges, and the very low numbers of any threatened, migratory, marine and cetacean species likely to be present coincident with discharge, the impacts to pelagic communities from drilling discharges are considered to be Slight (Magnitude: −1, Sensitivity: M).

9.15.3.2 SSDI and Surface Dispersant Applications – Planned Chemical Discharges

Prelude is located within the dispersant application exclusion zone as defined in the OPEP (Section 4.5.5), with the closest shallow water features being Echuca Shoals and Heyward Shoals: Echuca is located ~62 km East of the Activity Area in water depths of ~10-30 m, Heywood Shoals is located ~84 km north-east of the Activity Area in water depths of ~20-60 m. When the source of a spill is located within a dispersant exclusion zone, under certain environmental conditions and operational response circumstances, it may still be appropriate to use either subsea or surface dispersants. To exemplify this, subsea dispersant may be used in response to a loss of well control to reduce hydrocarbons at the surface, thereby allowing for safe operation of response teams onboard vessels or the MODU, which undertake critical response tasks which reduce or limit the duration of an overall spill event. In this example the use of the dispersant may be assessed as critical to bring a well back into control, which will have a greater net benefit to the environment than the potential negative effects of dispersants and dispersed hydrocarbons on local shoals and banks. Surface dispersant may be applied in response to a HFO spill. The extent of impacts from the use of dispersants will depend on the chemical dispersant type and dose rates, and external conditions (time of the year, weather and sea conditions, proximity of sensitive receptors and their life stage, etc.). These impacts will provide another consideration into the decision process on strategy selection (SIMA) and timing on a case-by-case basis at the time of the incident as described in the OPEP.

Surface and subsea dispersant application has the potential to increase in-water concentrations of hydrocarbons, including soluble aromatic compounds. Associated environmental effects include an increase in the mass of entrained hydrocarbons with smaller droplet sizes affecting larger areas and increased bioavailability for marine organisms (e.g. fish, plankton, benthic invertebrates). The effects of entrained hydrocarbons on sensitive environmental receptors are discussed in Section 9.14.2. Although these elevated concentrations will generally be of short duration, impacts may occur on values and sensitivities in the water column. Particular values and sensitivities in the area that may be affected by the dispersant chemical, and oil/dispersant mix in the water column are described below.

9.15.3.2.1 Physical Features, Values and Sensitivities

Marine Regions

The Planning Area is situated within NMR and NWMR (Section 7.4.1). The NMR comprises Commonwealth waters from west Cape York Peninsula to the Northern Territory–WA border. The Planning Area overlaps this region eastward as far as the Timor Seas and Croker Island, some of Arafura seas but not the Gulf of Carpentaria or waters off the Queensland coast. The NWMR region extends along the WA-NT border down to Kalbarri, Western Australia, encompassing an area of ~1,067,731 km^2. The region is characterised by shallow-water tropical marine ecosystems and is home to globally significant populations of internationally threatened species.

Given the generally targeted and short duration nature of dispersant application and broad extent of the associated marine regions, it is unlikely that key physical features of the NMR and NWMR (Section 7.4.1) would have significant exposure to dispersant and entrained hydrocarbons that would result from this spill response strategy. Residual impacts from the use of dispersants are expected to be low in nature and scale when assessed in isolation compared to the impact of the spill without dispersant application, and ranked as minor impact consequence (Magnitude: –2, Sensitivity: L).

Water and Sediment Quality

Environmental effects associated with dispersant application include a temporary reduction in water and sediment quality and exposure of marine biota to the inherent toxicity, biodegradability and bioaccumulation properties of dispersant chemical, which vary according to dispersant types. Additionally, dispersants combined with dispersed oil can increase the toxicity of spilled oil and this may affect sensitive receptors such as corals, seagrass, and macroalgae (Couillard et al. 2005).

Dispersant combined with hydrocarbons in the water column can be acutely toxic to marine biota (Couillard et al. 2005), with increased toxicity resulting from the chemical dispersant making the hydrocarbons more readily bioavailable (ERM 2013, Fuller et al. 2009). The elevated concentrations will generally be of short duration; however, impacts may occur on sensitive values and sensitivities in the water column. Values and sensitivities that may be affected by the use of dispersants in the water column are described in the following sections. Residual impacts from the use of dispersants are expected to be low in nature and scale when assessed in isolation compared to the impact of the spill without dispersant application, and ranked as minor impact consequence (Magnitude: –2, Sensitivity: L).

9.15.3.2.2 Natural Features, Values and Sensitivities

Timor Province Bioregion

Benthic Communities

By design, the application of chemical dispersants (surface and subsea) will break up oil into smaller droplets so that they are dispersed, diluted and biodegraded more rapidly in the water column. As such, dispersant use increases the risk to benthic habitats primarily through increasing the concentration of bioavailable hydrocarbons in the water column and facilitates the dissolution of any soluble compounds (French McCay and Payne 2001). In shallow water the temporarily increased concentrations of hydrocarbons within the water column may result in greater exposure of benthic habitat and sediments within the immediate response area. Most benthic habitats, including benthic fauna species have planktonic larval phases (e.g. corals, echinoderms, sponges) and sessile filter feeders are at greater risk of toxicity from chemically dispersed hydrocarbons than untreated hydrocarbons, however the sensitivity range of most species is such that, except in the immediate area and only for a short period of time following the dispersant application, impacts are expected to be minimal.

Nearshore benthic communities are also impacted by the application of chemical dispersants on oil. Studies have shown that the effects of physical contact (smothering) on subtidal habitats by the oil/dispersant mix can cause sublethal stress and reduced growth rates in seagrass (Zieman et al. 1984, Peters et al. 1997) and are likely to cause a decline in metabolic rates and partial mortality in corals (Shigenaka 2001, Negri and Heyward 2000). Photosynthesis may also be impaired in symbiotic zooxanthellae along with impaired respiration rates (Peters 1981, Knap et al. 1985). Smothering of macroalgae can reduce or block diffusion of CO^2 across cell walls (O'Brien and Dixon 1976) resulting in mortality or partial mortality. Studies following the Deepwater Horizon incident showed long-term, non-acute effects of the spill on coral colonies up to seven years following the event (Girard and Fisher 2018).

A 25-year study documented by DeMicco et al. 2011 on the net environmental benefits of the use of dispersants on benthic communities including mangroves, seagrass and coral in a tropical environment observed mortality to invertebrate fauna, seagrass, and corals in the short-term at both the dispersed oil and non-dispersed oil sites. In the long-term (10–25 years), as compared to the reference site, there was little to no oil detected and the ecosystem appeared to have returned to pre-dosing condition at the dispersed oil site. Although dispersant use resulted in short-term impacts, long-term disruption was not observed, and the area returned to pre-impact condition.

Sensitive reef communities are located within the Browse Basin, with the closest being around Browse Island, Echuca and Heywood Shoals and Ashmore and Cartier Islands, while seagrass meadows are located in some of these areas also. If applied appropriately, dispersants can provide a net environmental benefit by limiting exposure of an oil spill to high environmental value sensitive receptors. Elevated concentrations of dispersant are generally localised and of short duration, with dilution and dissipation being relatively rapid after application. Therefore, residual impacts from the use of dispersants are expected to be low in nature and scale when assessed in isolation compared to the impact of the spill without dispersant application, and ranked as minor impact consequence (Magnitude: −2, Sensitivity: L)

Pelagic Communities

Adverse effects on pelagic species may occur due to a change in water quality following application of chemical dispersants. Similar to benthic species, impacts to these organisms predominantly result from exposure to the dispersed, more readily bioavailable hydrocarbons and toxicity of the dispersant used.

Pelagic communities in the Planning Area for a worst-case spill scenario that may require use of dispersant include planktonic communities and pelagic fish and invertebrates. Planktonic communities are characterised by relatively rapid turnover rates of short-lived biota. The high turnover rate will lead to rapid recovery as the hydrocarbon/dispersant mix decays in the environment as a result of weathering and biodegradation processes. The concentrations of toxic hydrocarbons and dispersant in the water column will decrease with time and distance from release.

Pelagic fish populations are largely transient, and will likely move away from hydrocarbons in the open ocean (Hjermann et al. 2007). The temporary displacement of pelagic marine fauna from an area affected by dispersant application is a short- term, behavioural impact is considered to be negligible, and may result in a reduction of fish mortality due to avoidance of toxic plumes surrounding the spill site.

Most marine fish species produce very high numbers of eggs, which then undergo a planktonic larval development phase. Early life history stages of fish (planktonic eggs and larvae) may be more vulnerable to hydrocarbon pollution than juvenile and adults, as these early life history phases cannot actively avoid water with high concentrations of hydrocarbons. Fish embryos and larvae may exhibit genetic and developmental abnormalities from long-term exposure to low concentrations of hydrocarbons (Fodrie and Heck 2011), although such long exposures may not be representative of real-world conditions given the associated environmental conditions of the Planning Area (windy, strong currents). PAHs have also been linked to increased mortality and stunted growth rates of early life history (pre-settlement) of reef fishes, as well as behavioural impacts that may increase predation of post-settlement larvae (Johansen et al. 2017). Given the temporal and spatial scale of the worst-case credible spill scenarios, and the typically high supply of eggs and larvae, it is unlikely that any of the worst-case credible spill scenarios will result in significantly reduced recruitment of fish due to impacts during early life history phases. This conclusion is supported by studies of fish stocks following large-scale hydrocarbon spills, which have shown relatively little evidence of reduced recruitment at the scale of fish stocks/populations (Fodrie and Heck 2011).

Given the open ocean location of the Planning Area, the dissipative nature of dispersant within the marine environment, and the small proportion of any pelagic species population that may be affected by localised and temporary impacts to water quality, the impacts to pelagic communities from dispersant application are considered to be Minor (Magnitude: −2, Sensitivity: L).

Threatened, Migratory, Marine and Cetacean Species

Marine mammals may be exposed to dispersed oil within the water column externally (e.g. swimming through surface slick) or internally (direct ingestion or consumption of affected prey) (AMSA 2015, IPIECA 1995). Impacts from entrained and dissolved hydrocarbons to threatened, migratory, marine and cetacean species are further described in Section 9.15.3.4.3.

Research on the toxic effects of oil/dispersant mixture on fish and crustacean larvae found that the median lethal concentration for total petroleum hydrocarbons was ~4.0 mg/L (4000 ppb), compared to hydrocarbons treated with chemical dispersants where it ranged from ~22 mg/L to 62 mg/L. For dispersant exposures alone, the median lethal concentration ranged from 17 mg/L to 50 mg/L (Couillard et al. 2005). The differences in the relative toxicity among the tests indicated that most petroleum hydrocarbons in the chemically enhanced test are in less acutely toxic forms than the components that dominate the untreated tests (Couillard et al. 2005). In any case, dispersant application as a response option will be strategically assessed by the IMT including the development of an Operational SIMA, which considers the net environment benefit gained and will only be selected if the success of the response option outweighs environment impact. If applied appropriately, dispersants can provide a net environmental benefit by limiting exposure of an oil spill to receptors of high environmental value. Chemical dispersant has been applied successfully for several large well control events, including Montara in 2009. As such, these practices are well understood within the industry. Elevated concentrations of dispersant are generally localised and of short duration, with dilution and dissipation being relatively rapid after application. Therefore, residual impacts from the use of dispersants are expected to be low in nature and scale when assessed in isolation compared to the impact of the spill without dispersant application, and ranked as minor impact consequence (Magnitude: –2, Sensitivity: M).

9.15.3.3 Decanting Operations/Contain and Recover – Discharge of Liquid Wastes

9.15.3.3.1 Physical Features, Values and Sensitivities

Water Quality

In order to optimise recovery of floating hydrocarbon removed from the sea surface during Contain and Recover operations, it may be required to decant some of the oily water from temporary storage back into the ocean which may result in dissolved and entrained hydrocarbons being released back into the marine environment. This is not expected to lead to additional environmental impacts compared to the pre-application state of this strategy as the decanted water will be released at the spill site within already affected boomed areas and not elsewhere. Thus, no additional adverse environmental impacts are expected for water quality and marine biota and the residual impact consequence is assessed as nil (Magnitude: 0, Sensitivity: L).

9.15.3.4 Shoreline Clean-up and Protection of Sensitive Resources– Disturbance to Ground and Lighting

The oil spill modelling for the worst-case Prelude HFO scenario indicates that shoreline oil >100 g/m^2 (the threshold where shoreline cleanup is beneficial, Section 9.14.1.10) occurs at multiple shoreline locations. Given that the shortest period to exposure at these levels is >33 days it is expected that the accumulating HFO would be highly weathered, forming thick smothering of shorelines. Clean-up activities would offer the potential for net environmental benefit. However, discussion of the potential effects of response activities is included below for completeness.

9.15.3.4.1 Protected Areas

Marine Conservation Reserves

Shoreline contact at protected areas above 100 g/m^2 is limited to Ashmore Reef AMP, which provides habitat for a number of EPBC Act listed species. The potential impacts of response activities on these values are discussed in Section 9.15.3.4.2. Given the controls in place and the short-term and localised incidental environmental effects from shoreline clean-up activities, there would only be Minor residual impact

consequences presented by personnel and equipment undertaking shoreline clean-up activities (Magnitude: −2, Sensitivity: M).

9.15.3.4.2 Natural Features, Values and Sensitivities

Offshore Reefs and Islands

Conducting shoreline clean-up activities, including moving personnel and equipment, has the potential to cause damage to terrestrial and intertidal habitats, with subsequent impacts to dune/beach structure, flora (e.g. macroalgae) and fauna (e.g. turtles and birds including nests). Invasive or frequent clean-up can also involve physical removal of substrates that could adversely impact habitats and fauna and alter coastal geomorphology and hydrodynamics. The impacts associated with undertaking shoreline clean-up may be more than if the product was left in place and remediated through natural processes (Natural Recovery). Leaving the product in place is a very common response option if continual human and vessel/vehicle traffic has the potential to generate greater impacts than the product itself. The optimal suite of response strategies will be determined through the SIMA process described in the BROPEP.

Deploying booms to protect shorelines and intertidal environments could potentially cause physical damage to coral reefs/intertidal ecosystems through boom and/or anchor movements. Reviewing shoreline and shallow-water habitats and bathymetry and establishing demarcated areas for access and anchoring will reduce impacts to nearshore environments.

Given the controls in place and the short-term and localised incidental environmental effects from shoreline clean-up activities, there would only be Minor residual impact consequences presented by personnel and equipment undertaking shoreline clean-up activities (Magnitude: −2, Sensitivity: M).

9.15.3.4.3 Threatened, Migratory, Marine and Cetacean Species

Shoreline clean-up and protect/deflect activities will be managed to minimise impacts on turtles (including hatchlings) and birds (and other fauna) by minimising disturbance to important habitats, such as nesting and feeding sites. Small boats or helicopters would be used to transfer responders to shore, and they would be accommodated on nearby medium-sized vessels or facilities such as Prelude (if available). Assessing appropriate equipment and personnel numbers required to reduce habitat damage, along with establishing access routes/demarcation zones, and operational restrictions on equipment and personnel movements will limit sensitive habitat damage and damage to important fauna areas. Temporary camp areas will be established in consultation with WA DBCA, WA DoT and NT DEPWS.

Although unlikely, shoreline response activities may require use of lighting, which can cause disorientation and/or disruption to nesting and breeding behaviours in seabirds, shorebirds and turtles. The need to conduct night-time operations in sensitive areas will be assessed and operational restrictions established. It is considered unlikely that operations will be conducted at night because of the remote location of potentially impacted shorelines, the use of small teams to conduct response operations to reduce ecological impacts (see Section 12.3 of the BROPEP) and the safety implications associated with dangerous marine fauna (e.g. saltwater crocodiles).

Given the controls in place and the short-term and localised incidental environmental effects from shoreline clean-up activities, there would only be Minor residual impact consequences presented by personnel and equipment undertaking shoreline clean-up activities (Magnitude: −2, Sensitivity: M).

9.15.4 Impact Assessment Summary

Table 9-133 lists the highest residual impact consequence rankings of the relevant environmental receptor groups.

Table 9-133: Spill Response Strategies Evaluation of Residual Impacts

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Evaluation – Planned Impacts			
Protected Areas	−2	M	Minor

Environmental Receptor	Magnitude	Sensitivity	Residual Impact Consequence
Physical Features	-2	L	Minor
Physical Values and Sensitivities	−2	L	Minor
Natural Features	−2	L	Minor
Natural Values and Sensitivities	−2	M	Minor
Socioeconomic Features	N/A	N/A	N/A
Socioeconomic Values and Sensitivities	N/A	N/A	N/A
Heritage and Cultural Features	N/A	N/A	N/A
Heritage and Cultural Values and Sensitivities	N/A	N/A	N/A

9.15.5 ALARP Assessment and Environmental Performance Standards

Table 9-134 presents the ALARP assessment of oil spill response capability. A description of controls, EPSs and measurement criteria for each oil spill response strategy are presented in the BROPEP.

9.15.6 Acceptability of Impacts

Table 9-134: Acceptability of Impacts – Oil Spill Response Strategies

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Subcategory**			
Protected Areas	Marine conservation reserves	No impacts to the values of marine parks.	Yes	SCAT and shoreline cleanup or protection of sensitive resources activities only activated where net environmental benefit predicted and subject to implementation controls in consultation with relevant agencies to ensure no significant adverse impacts to fauna or habitats that represent marine park values.
Physical features, values and sensitivities	Marine regions	No significant impacts to the physical features of a marine region.	Yes	The discharge of drilling fluids and cuttings has the potential to result in reduced water quality at the discharge location, however discharges will dilute in the open ocean environment. Modelling studies indicate impacts to water and sediment quality are highly localised around the discharge location (being open offshore waters with no significant seabed features), which is consistent with industry monitoring studies. Shell will implement measures to reduce the potential for impacts to water and sediment quality from drilling discharges. Slight impacts that are localised to the vicinity of the relief well drilling location are considered acceptable. Spills from decanting and the application of dispersant may result in a temporary reduction in water quality. The level of toxicity varies amongst the different dispersant types and can result in increased in-water concentrations of the toxic components of hydrocarbons. Dispersant combined with dispersed oil can be acutely toxic in the water column, however the elevated concentrations will generally be of short duration. Dispersant application has a limited window of opportunity, as the ability for the dispersants to break up the hydrocarbons typically decreases as the product weathers therefore surface application would only be considered as a secondary response option for an HFO spill in conjunction with the operational SIMA, Shell Surface Dispersant Application Guide and the necessary regulatory approvals. The targeted and short duration nature of these response activities makes it unlikely that key physical features of the marine regions would be significantly exposed and impacted. Residual impacts from the use of dispersants are expected to be low in nature and scale
	Water quality	No significant impacts to water quality. Impact not expected to result in a substantial change in water quality, which may adversely impact biodiversity, ecological integrity, social amenity or human health.	Yes	
	Sediment quality	No significant impacts to sediment quality. Impact not expected to result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social	Yes	

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Subcategory**			
		amenity or human health may be adversely affected.		when assessed in isolation compared to the impact of the spill without dispersant application.
Natural features, values and sensitivities	Marine bioregions	No significant impacts to benthic habitats and communities. No significant adverse effect on pelagic communities, populations, habitats or spatial distribution of a species. No substantial adverse effect on a population of a marine species including its lifecycle and spatial distribution. No known or potential pest species become established in the Commonwealth Marine Area.	Yes	The benthic habitats and communities within the area of potential affects from relief well drilling discharges are broadly distributed and not considered unique or particularly sensitive. Impact predicted to be highly localised to the activity location. Given the dispersion and dilution predicted following discharge, mobile species are unlikely to be exposed to substantially reduced water quality for sufficient durations to have significant impacts on mobile species. Temporary displacement of pelagic marine fauna is considered a negligible impact. Localised scale of effects represents a negligible proportion of regional planktonic assemblage distributions which are expected to rapidly recover from any adverse effects. Given the absence of important habitat and ecological assemblages of pelagic species, no significant adverse impact on pelagic communities, populations, habitats or spatial distribution of a species expected. Increased in-water concentrations of toxic components of hydrocarbons due to dispersant application may result in greater exposure of benthic habitats and sediments within the immediate response area however this would generally be temporary with rapid dilution. Planktonic communities with short lived biota will rapidly recover, and it is considered unlikely that a significant reduction of fish populations would occur due to localised impacts to early life cycle phases. This is considered acceptable for the net environmental benefit of limiting exposure of high value sensitive receptors to an oil spill plume. SCAT and shoreline cleanup or protection of sensitive resources activities only activated where net environmental benefit predicted and subject to implementation controls in consultation with relevant agencies to ensure no significant adverse impacts. The optimal suite of response strategies will be determined through the operational SIMA.
	Offshore Reefs and Islands	No significant impacts to offshore reefs and islands.	Yes	The shoreline response strategies are designed to avoid sensitive habitats on offshore islands and nearby shorelines, using small controlled teams with

Receptor		Acceptable Level of Impact	Acceptable?	Acceptability Assessment
Category	**Subcategory**			
				restricted lighting and limited access so that any disturbance remains short term and localised. These measures ensure that residual effects are minor, reversible, and do not alter habitat condition or fauna use of offshore island environments. Strategies impacting offshore reefs and islands are only activated where net environmental benefit is predicted and subject to implementation controls in consultation with relevant agencies to ensure no significant adverse impacts. The optimal suite of response strategies will be determined through the operational SIMA. Given these controls and the limited scale and duration of the activity, the predicted outcomes remain consistent with the acceptable level of impact of "no significant impacts to offshore reefs and islands."
	Threatened, migratory, marine and cetacean species	No mortality or injury of cetaceans. Management of aspects of the activity must align with conservation advice, recovery plans and threat abatement plans. No significant impacts to EPBC Act listed threatened, migratory, marine or cetacean species.	Yes	The number of EPBC Act listed species within the localised area temporarily affected by relief well drilling discharges is expected to be low, with a lack of aggregation areas and productive benthic habitats for listed species in the relief well area. Many are air breathing vertebrates, which are unlikely to be directly affected as their skin is relatively impermeable. Temporary disturbance to low numbers of individuals will not cause significant impacts. Application of dispersant, SCAT and shoreline cleanup or protection of sensitive resources activities will only be activated where net environmental benefit is predicted and subject to implementation controls in consultation with relevant agencies to ensure no significant adverse impacts or mortality and/or injury to cetaceans.

New and/or unique environmental impacts associated with implementation of the possible spill response strategies are considered acceptable where they present a net environmental benefit compared to the 'do nothing' option as determined and documented through the SIMA process (as described in the BROPEP).

Assessment of these impacts from the spill response strategies discussed above determined the residual ranking of Minor or lower (Table 9-133). The acceptability of these impacts has been considered in the context of:

Principles of ESD

The response option impacts described above are consistent with the principles of ESD because:

- The health, diversity and productivity of the marine environment will be optimised for future generations through minimising the impact of any large scale spills through implementation of the accepted OPEP and associated response strategies.
- The precautionary principle has been applied, and studies undertaken where knowledge gaps were identified. This knowledge has been applied during the evaluation of environmental impacts.
- With the prevention and mitigation controls in place, the conservation of biological diversity and ecological integrity shall be optimised following a large scale spill.

Relevant Requirements

Management of the impacts associated with spill response strategy implementation are consistent with relevant legislative requirements, including:

- The NOPSEMA accepted BROPEP (HSE_GEN_016765).

Matters of National Environmental Significance

Threatened and Migratory Species

Alignment with the relevant management plans, recovery plans and conservation advice for threatened and migratory fauna will be addressed on a case-by-case basis through the SIMA process when selecting appropriate spill response strategies (See 7.7.10.6) for the list of potentially applicable plans and advisory documents). These plans and advisory documents will assist with determining protection priorities once the nature, scale and trajectory of the spill is understood.

Commonwealth Marine Environment

The new and/or unique environmental impacts presented by relief well drilling, dispersant application, decanting and/or shoreline clean-up on the Commonwealth marine environment when assessed in isolation from the spill event itself will not credibly exceed any of the significant impact criteria as listed in Table 8-1.

External Context

No objections or claims have been raised by relevant persons to date regarding oil spill response strategies. Shell will consider any future claims or objections from relevant persons as part of its ongoing consultation program (see section 5). Where new impacts or risks are established these will be subject to the MOC process described in Section 10.4.4

Internal Context

Shell has also considered the internal context, including Shell's environmental policy and ESHIA requirements. The EPOs, and the controls that will be implemented, are consistent with the outcomes from consultation for the petroleum activity and Shell's internal requirements.

Acceptability Summary

The acceptability of the associated impacts have been considered in the context of:

- the established acceptability criteria
- ESD
- relevant requirements

- MNES
- external context (i.e. relevant persons claims or objections)
- internal context (i.e. Shell requirements).

The potential residual impacts are deemed to be minor, which Shell considers to be acceptable if they meet legislative and Shell requirements. The discussion above demonstrates that these requirements have been met in relation to the new and/or unique impacts associated with implementing the spill response strategies. Shell considers the residual impacts to be ALARP and acceptable.

9.15.7 Environmental Performance Outcome

EPO #	EPO	Measurement Criteria
13.1	Select and implement spill response strategies to minimise the overall environmental impacts from a spill and the associated response strategies.	BROPEP implementation records and SIMA records.

10 Environmental Plan Implementation Strategy

Section 2 of the OPGGS(E) Regulations requires a strategy to be incorporated into the EP that describes the environmental management system; responsibilities of employees and contractors; monitoring and reporting; oil pollution emergency response and testing; and consultation and compliance to be implemented for the Activity.

10.1 Management Systems

The Shell Management System (Management System – (MS)) provides a structured and documented system for effectively managing impacts and risks in compliance with relevant Shell SEAM Standards (Sections 4.3 and 10.2), and within the boundary of the overarching Shell Performance Framework (Section 4.1) and HSSE & SP Policy & Commitment (Section 4.2). The MS consists of the key management system elements such as Governance; Legal; Health; Process Safety; Personal Safety; Security; Environment; Projects; Transport; Social Performance and Product Stewardship; Leadership & Commitment; Policy & Objectives; Organisation, Responsibilities & Resources; Learning and Competence; Managing Risk; Planning & Procedures; HSSE Consultation/Communication; Emergency Response; Permit to Work; Management of Change; Incident Investigation and Learning; Performance Monitoring and Reporting; HSSE Assurance; Audit and Assurance; Manage Exceptions; and Management Review.

The Management System is implemented subject to a continuous improvement cycle based on the 'plan, do, check, review' loop, with a focus on the key activities outlined below in Table 10-1. There are numerous, specific assurance activities against each of these key systems.

The audit and review function seeks to ensure that the system is being implemented, that the requirements are effective in implementation of the Shell Commitment and Policy on HSSE & SP (Figure 4-3) to achieve EPSs, and that continuous improvement is implemented. Examples of elements that demonstrate continuous improvement are highlighted under each section.

Table 10-1: Management System – Key Implementation and Improvement Activities

Management System Element	Implementation and Improvement
Leadership and Commitment *Creating and sustaining a culture that drives Shell's commitment of no harm to people or the environment*	Seek ongoing feedback on how others perceive HSSE & SP leadership (performance reviews, HSE Culture Survey [Shell People Survey], 360 Feedback).
Policy and Objectives *Supporting the implementation of Shell HSSE & SP Commitment and Policy*	Set annual HSSE & SP targets to drive continuous performance. Annually Review and approve HSSE & SP objectives.
Organisation, Responsibilities and Resources *Establishing and maintaining an organisation that enables the compliance with the SEAM Standards*	When there are changes in the Business or organisation, identify the positions that require Competence assurance. HSSE & SP Critical Position Register, Shell People Competency Profiles.
Risk Management *Identifying the HSSE & SP hazards and establishing the controls to reduce the risks to ALARP*	Ongoing review of Hazards and Risks. Regular review of Risk Registers.
Planning and Procedures *To integrate the requirements of the HSSE & SP Control Framework into business plan and procedures: Emergency & Crisis Response, Spill Preparedness and Response, MOC, PTW*	Establish and maintain a programme of testing of Emergency Response plans and procedures at least once a year or more frequently based on the level of risk. Shell Australia Emergency Response Plan (ERP), records of Emergency Response (ER) drills, exercises and After Action Reviews (AARs).

Management System Element	Implementation and Improvement
Implementation, Monitoring and Reporting *Implement the HSSE & SP requirements embedded in plans and procedures and take corrective action when necessary*	Report all Incidents, including Near Misses, to the Supervisor of the work activity. Learn from Significant Incidents and High Potential Incidents through communication and implementation of required actions.
Assurance *Providing assurance that SEAM Standards are implemented and effective*	Establish, maintain and execute HSSE & SP Self-Assessments in support of the Business HSSE & SP Assurance Plan, self-assessment, Gap Analysis, HSSE & SP Management Review. Management Review (documents demonstrating how Shell Australia reviews the effectiveness, adequacy and fitness for purpose of the HSSE & SP MS and take action to improve). Review the HSSE & SP MS and its individual elements at least once a year and document the results.
Management Review *Reviewing the effectiveness, adequacy and fitness for purpose of the HSSE & SP MS and taking actions for improvement*	Assess the Effectiveness and Adequacy of the management system in delivering the Policy and Objectives, and in driving continual improvement.

10.2 Shell Safety, Environment, and Asset Management (SEAM) Standards

Prelude processes are linked to and governed by the Shell SEAM Standards, consisting of five standards, each containing a number of specific requirements. SEAM standards include (Figure 4-4):

- HSSE & SP Asset Management Foundations (Section 10.3)
- Process Safety and Asset Management (Section 10.4)
- Workplace Health, Safety & Security (Section 10.6)
- GHG and Energy Management (Section 10.7)
- Transport Safety (Section 10.9.4)

Each of the elements within the SEAM Standards are assigned a process owner who is accountable to ensure effective implementation. These work processes are described in a structured set of documents ranging from manuals, procedures, and work instructions to provide the clarity on why and how each of the process steps are to be executed in a structured and aligned manner.

10.3 HSSE & SP Asset Management Foundations

The Health, Safety, Security, Environment and Social Performance (HSSE & SP) and Asset Management Foundations Standard includes Shell Group Requirements intended to manage the common/foundational elements of risks and controls. Ineffective governance and/or ineffectiveness of managing the HSSE & SP and Asset Management risks may lead to potential incidents affecting people, assets, environment, and/or community.

10.3.1 Contractor HSSE Management

Contractors and their subcontractors carry out numerous activities on behalf of Shell. Effective management of environmental, health, and safety risks in contracts involves Shell setting clear expectations, providing clear documentation and guidelines, and managing these risks throughout the contract lifecycle.

Shell implements specific processes and activities aimed at ensuring that contracts consistently and effectively manage HSSE & SP risks for the contracted activities. These processes are detailed in the HSSE & SP Contractor Management Strategy Manual. The contractor management processes implemented for Prelude are consistent with these requirements.

Key aspects of contractor HSSE management requirements are:

- Pre-contract award activities:
  - Determine the Contract HSSE & SP risk by assessing the risk associated with the contracted activities.
  - Determine the contract mode.
  - For a high risk HSSE contractor, the contractor is to develop and provide a Contract HSSE Plan.
  - Assess whether the contractor has the capability and resources to manage the risks associated with the contracted activities.
  - Before awarding the contract, confirm that the contractor meets the requirements. Focus on closing gaps in the draft contract HSSE & SP Plan submitted by the contractor.
  - Define the level of company monitoring based on the capability of the contractor, the contract HSSE & SP risk and the contract mode.
  - Appointing a competent contract owner and contract holder for each contract.
- Post-contract Award Activities:
  - Require the contractor to demonstrate that its personnel who are responsible for managing the HSSE risks of the contracted activity understand the HSSE requirements of the contract and any associated Contract HSSE Plan related to their role.
  - Require the contractor to demonstrate that all its personnel will receive an induction on the HSSE risks of the contracted activities including the controls to manage those risks specified in the contract and any associated Contract HSSE Plan.
  - Verify that the HSSE requirements of the contract and any associated Contract HSSE Plan are being implemented and are effective at managing the HSSE risk of the contract. Where necessary, implement actions for improvement.
  - Regularly assess the HSSE performance of the contractor, including its management of subcontractors.
  - Business Performance Review process – regularly assess the HSSE performance of the contractor, including its management of subcontractors.

10.3.1.1 Contract Mode Matrix

Shell differentiates between contracts by mode designation. The contract mode determines which HSSE & SP MS will be applied to the activity being performed under the contract. The contract modes are described in Table 10-2.

Table 10-2: Contract Mode Matrix

Mode	Governing HSSE & SP MS	Description	Assurance Process
1	Shell	Typically assigned when contractor staff are working under a Shell HSSE & SP MS alongside Shell staff. The contractor provides people, processes, and tools for the execution of the contract under the supervision, instructions, and HSSE & SP MS of Shell. The contractor has a MS to provide assurance that the personnel for whom it is responsible are qualified and fit for the work and that the processes, tools, materials, and equipment they provide are properly maintained and suitable for the contract.	Shell management level review and site level audits and inspections.
2	Contractor HSSE & SP MS Bridging	Assigned to contractors working under their own HSSE & SP MS in an area on a Shell owned or contracted facility. Activities are external but have an interface to a Shell facility	Shell management level reviews to

Mode	Governing HSSE & SP MS	Description	Assurance Process
	document to Shell MS	(e.g. marine vessels under term charter (Multi-Purpose Support Vessel, In-Field Support Vessel), helicopter transport) are normally managed under Mode 2 contract. The contractor executes all aspects of the contract under its own HSSE & SP MS, providing the necessary instructions and supervision and verifying the proper functioning of its HSSE & SP MS. Shell has the right to verify the overall effectiveness of the HSSE & SP MS controls in place, including the interface with subcontractors and assuring that the Shell and contractor HSSE & SP MS are compatible.	assess contractor's capability, suitability, and material equivalence of the Contractor HSSE & SP MS.
3	Contractor HSSE & SP MS	Work is conducted at the contractor's site and HSSE & SP risks are managed under the contractor's HSSE & SP MS. Contractor operates within its own HSSE & SP MS that has no interfaces with the Shell HSSE & SP MS.	If appropriate, site visit to ensure HSSE & SP of premises.
Multi-Mode	Determined by mode of individual activity with bridging document to Shell HSSE & SP MS where required	In certain circumstances, contracted services span several activities and/or are delivered at various locations. In these circumstances contracts are identified as multi-mode and work is broken down into smaller, identifiable activities each with a mode and party assigned for management of HSSE & SP risks. Depending upon location, HSSE & SP risks are managed under the contractor's or Shell's HSSE & SP MS. Interfacing must also reflect the individual activities.	Shell management level reviews to assess contractor's capability, suitability, and compatibility of HSSE & SP MS.

10.3.1.2 Contractor Competency Requirements and Assurance

The contractor is responsible for ensuring that all its personnel have the appropriate level of competence required to carry out the work safely and effectively, and for the development and implementation of a Competence Assurance Plan. The Shell contract holder is responsible for ensuring that the contractor's competence assurance system is reviewed, robust, and meets Shell requirements.

In addition to trade competencies and qualification requirements, the minimum competence requirements for contractors working on Shell offshore facilities are:

- Basic Offshore Safety Induction and Emergency Training (BOSIET) and Escape Chute;
- Facility induction (such as Life Saving Rules, ER and muster procedures, incident reporting); and
- Role-specific training as required (such as Permit to Work, PTW)
- In addition to these competence requirements the contractor must have current:
- Fitness to work certification (relevant to the tasks to be performed); and
- Maritime Security Identification Card
- Maritime Security, Assist and Assure Frontline, Prelude HSSE + SP e-learning competency.

10.3.2 Organisation, Roles and Responsibilities

10.3.2.1 Chain of Command

The high level organisational structure of the Prelude FLNG is summarised in Figure 10-1. The following Shell Group organisational chain of command structure provides leadership and direction for operations activities:

- President, Integrated Gas reports to the Chief Executive Officer.

- Country Chair reports to the President, Integrated Gas.
- Vice President of Prelude-Crux reports to the Country Chair.
- Operations Manager reports to the Vice President Prelude-Crux (EP Owner).
- Production Manager and Prelude OIM reports to the Operations Manager.

The role of the County Chair and Country Coordination Team retains governance and oversight of the Asset chain of command reporting lines throughout all activities. The Vice President Prelude-Crux is ultimately accountable for the Prelude facilities and activities (Table 10-1) and will implement this primarily through an Operations Manager and Maintenance, Turnaround and Construction (MTAC) Manager.

Reporting to the Operations Manager, the Offshore Installation Manager (OIM) oversees the Prelude and Crux (once in operations phase) facilities management (in command of the facilities and responsible for their safe operation). The OIM role is continuously occupied while the facility is in operation. If the OIM is incapacitated, the role is filled by a competent person delegated by the OIM or Operations Manager. The Production Manager oversees the production function with direct reporting from the Prelude Area Team Leads, Production Unit Lead and subsequent support teams. The MTAC Manager oversees the planning and execution of minor and major maintenance programs and turnarounds throughout operations.

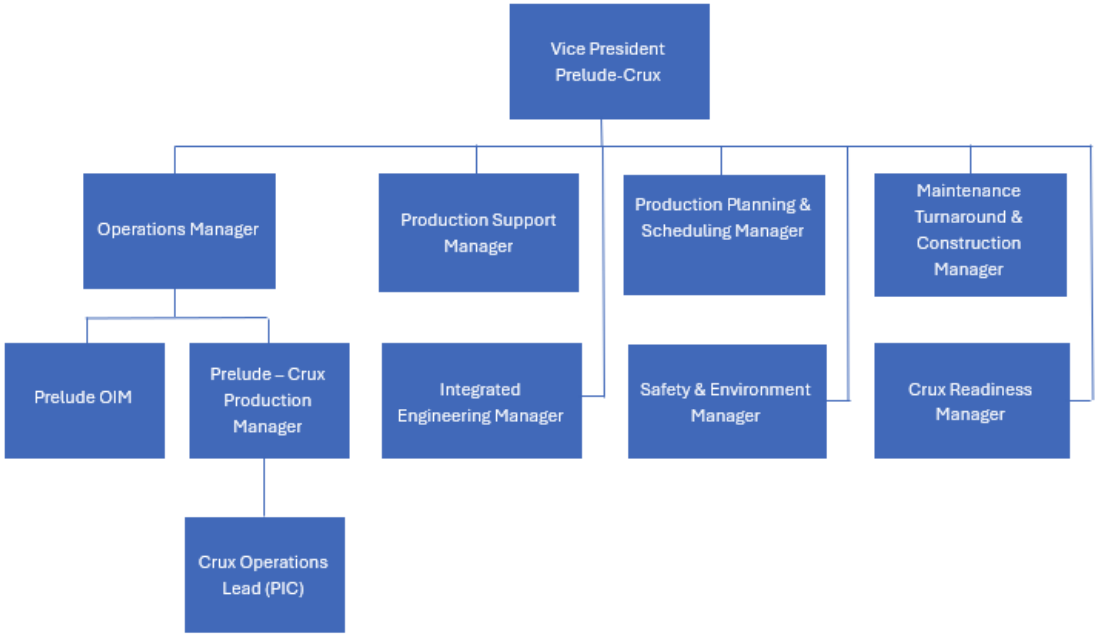


Figure 10-1: Prelude Asset Organisation Structure

10.3.2.2 Support Teams

The chain of command structure for Prelude is supported by a diverse team (both onshore and offshore) to deliver on the Operating Plan, including:

- Production, Operations and Maintenance support disciplines
- Prelude-Crux Environment Advisers report to the Safety & Environment Manager
- Functional support teams report to the corresponding Functional Vice President
- Support teams include Engineering, Wells, Marine, and Aviation.
- Production support engineering team includes PTM surveillance, design, process safety, and technical integrity
- Subsea engineering team is responsible for the IMR activities on subsea infrastructure including facility structures, flowlines, manifolds, and subsea isolation valves to ensure integrity

- Wells team ensures the safe planning and execution of well maintenance operations
- Project engineering team is responsible for the engineering, construction, and execution of small projects on operational facilities to ensure ongoing integrity and safe operation
- Marine operations team is responsible for chartering, mobilising, demobilising, and marine vessel assurance
- Aviation team provides personnel transport, material transport, emergency evacuation and search and rescue capabilities.

Other services and functions provided by the business unit include, but are not limited to:

- Integrated engineering including managing maintenance strategies, systems, applications, standards/guidelines to optimise operations and support governance processes
- Coordination of production engineering and maintenance execution processes and resources
- Coordination of production planning and scheduling
- Management and maintenance of Environmentally Critical Equipment(ECEs)
- Provision of technical support (MOCs, EP compliance including ALARP reviews, action closures and EP revision)
- Incident reporting and investigation in line with Shell standards and EP requirements
- IMT support (in the unlikely event of an emergency incident).

An overview of accountabilities of key personnel in relation to the implementation, management and review of the EP is outlined in Table 10-3. It is the responsibility of all Shell employees and contractors to adhere to and implement their key responsibilities throughout the life cycle of a project and to ensure that they are suitably trained and competent in their assigned roles.

Key roles and responsibilities related to the management and implementation of oil spill response arrangements in the event of an emergency event are outlined within the BROPEP (see Section 10.15.3).

Table 10-3: Key Responsibilities

Title (Role)	Main Responsibilities/Accountabilities
Vice President Prelude-Crux (EP Owner)	• Accountable for EP implementation. • Accountable for safe, efficient and environmentally compliant operation of the facility. • Oversight of Operations Manager and MTAC Manager and related functions and duties during operations. • Accountable for incident notification, reporting and investigation in line with regulatory requirements. • Accountable for ensuring all necessary regulatory approvals are in place to operate. • Custodian of communication with all regulatory agencies required to operate the facility. • Accountable for environmental performance and initiative delivery. • Accountable for environmental performance to drive continuous improvement. • Accountable for the implementation of relevant person consultation as per the description in this EP. • Responsible for approval of Red risk deviations.
Operations Manager	• Accountable for HSSE and offshore prioritisation and coordination. • Accountable for operations. • Accountable for assessing risk (with inputs from HSSE, MTAC, Engineering and Production Support) • Accountable for permit to work system. • Accountable for emergency response management. • Accountable for ensuring that mitigation controls for deviations are implemented and monitored. • Responsible for approval of Yellow and Blue risk deviations. • Support role for EP implementation.
Integrated Engineering Manager	• Accountable for overall engineering compliance with all legislative requirements. • Accountable for ensuring that the management of change and engineering support workflow systems and processes are adhered to. • Accountable for compliance with all engineering elements of business processes within the defined area/asset including the management of change workflow. • Accountable for the development of brownfield projects from concept identification through to ready for construction • Accountable for management of the ECE process. • Support role for EP implementation.

Title (Role)	Main Responsibilities/Accountabilities
Production Support Manager	• Accountable for overall day-to-day process engineering, production chemistry and laboratory compliance with all legislative requirements. • Accountable for process optimisation. • Accountable for ensuring that the process surveillance, production chemistry and laboratory workflow systems and processes are adhered to. • Support role for EP implementation.
Maintenance, Turnaround, and Construction (MTAC) Manager	• Responsible for planning and coordination of minor and major maintenance, turnarounds, and brownfields construction scopes. • Responsible for the safe execution of the maintenance work plan to manage asset integrity of the facility and to support the EP. • Support role for EP implementation.
Prelude-Crux Production Manager	• Reports directly to the Operations Manager. • Responsible for the overall production from the facility and oversight of the Production and Operations Team. • Support role for EP implementation.
Prelude OIM	**Systems, Practices and Procedures** • Accountable for the health and safety of the offshore workforce. • Accountable for field management plans. • Support for EP implementation. • Ensures offshore personnel comply with regulatory requirements and Shell's policies and standards. • Accountable for offshore compliance with regulatory requirements and Shell's polices and standards. • Accountable for the Permit to Work governance, process and permit requirements. **Resourcing, Training and Competencies** • Provides appropriate offshore resources to comply with EP requirements. • Accountable for the performance and development of production, services and maintenance teams and ensuring capability and competency. **Monitoring, Auditing, Non-conformance and Emergency Response** • Accountable for monitoring performance against the EP. • Implements environmental assurance activities and audits and implementing and monitors action tracking closure. • Ensures incidents are reported and investigated in line with Shell standards and EP requirements. • Responsible for acting as the Incident Controller during emergencies. • Responsible for ensuring emergency exercises and drills are performed.
Operations Specialist	**Systems, Practices and Procedures**

Title (Role)	Main Responsibilities/Accountabilities
	• Responsible for ensuring compliance to all relevant environmental regulatory requirements as defined in this EP and Shell standards and procedures. • Accountable for the day-to-day operations of the facility including effective shift handover, completion and logging of operator routine environmental performance. • Accountable and responsible for permits and isolation for all frontline maintenance activities. • Responsible for the execution of the maintenance work plan to manage asset integrity of the facility and to support the EP. • Responsible for leading and coordinating a multi-disciplined team performing specific duties to support the asset integrity of the facility, including helicopter operations, vessel movements and movement of goods and materials. • Implements environmental initiatives. **Resourcing, Training and Competencies** • Resource planning and allocation for the operations and maintenance teams. • Management and coordination during emergencies **Monitoring, Auditing, Non-conformance and Emergency Response** • Responsible for assisting with assurance activities and incident reporting and investigation as required.
Offshore HSSE Advisors	**Systems, Practices and Procedures** • Liaises with OIMs and Operations Specialist/Team leads on day-to-day management of environmental risks and issues. • Identifies opportunities for continuous improvement and communicates these to the OIMs and Shell Australia Environment Team. **Resourcing, Training and Competencies** • Coaches and assists in implementing environmental improvement initiatives. • Coaches relevant personnel to understand the requirements in the EP applicable to their role. **Monitoring, Auditing, Non-conformance and Emergency Response** • Assists with the ongoing promotion of environmental performance at the facility including environmental reporting, monitoring and review. • Assisting with assurance activities and incident reporting and investigation as required.
S&E Manager	• Accountable for HSSE reporting. • Support EP implementation. • Responsible for monitoring and reviewing progress against EP, targets and KPIs. • Responsible for ensuring compliance with the EP and driving continuous improvement. • Escalate any potential environmental issues and non-compliances to the leadership team.

Title (Role)	Main Responsibilities/Accountabilities
Operations Maintenance Coordinator	**Systems, Practices and Procedures** • Responsible for reviewing CMMS notifications of equipment impairment and risk assessing for rectification. • Responsible for informing the Environment team of ECE impairments for review/escalation. • Responsible for screening a deviation request and verifying proposed mitigative controls. • Responsible for reviewing and approving non HSSE critical deferrals.
Offshore Maintenance Execution Focal	**Systems, Practices and Procedures** • Responsible for the completion of ECE maintenance tasks, recording results within CMMS and raising deviations for review of any issues prior to the LAFD.
ECE Group Owner	**Monitoring, Auditing, Non-conformance and Emergency Response** • Responsible for developing the Performance Standard for relevant ECE or Safety Critical Equipment (SCE) barrier group, including functional criteria, assurance tasks/measures and required activity upon impairment of ECE. • Responsible for ensuring the maintenance strategy for ECE/SCE equipment is correctly implemented. • Responsible for monitoring the health and function of ECE/SCE equipment, ensuring it meets the defined performance standards by reviewing data and managing the maintenance strategy. • Responsible for assessing ECE impairments against the ECE performance standard and consulting with relevant Operational roles to provide technical advice to the Environment team. • Responsible for risk assessing ECE deviation requests and approving non HSSE critical deferrals
Prelude-Crux Environment Advisors	**Systems, Practices and Procedures** • Ensuring appropriate personnel have access to the EP and understand the outcomes, standards and measurement criteria and their environmental responsibilities for the activity. • Liaising with applicable regulatory authorities and stakeholders as required. • Develops risk reduction strategies and defines Performance Standards. • Facilitates ALARP & Acceptability reviews. • Update of the EP as required. • Facilitate and provide coaching for environmental improvement plans. **Resourcing, Training and Competencies** • Developing and maintaining environmental training, and coaching materials for deployment to Prelude organisation. **Monitoring, Auditing, Non-conformance and Emergency Response**

Title (Role)	Main Responsibilities/Accountabilities
	• Responsible for environmental monitoring and reporting requirements from the EP including environmental performance and compliance reporting. • Monitoring progress against environmental improvement plans • Participating in environmental audits/inspections to ensure regular checking of compliance to this EP. Communicating findings to management and assisting with close out of actions. • Assisting with review, investigation and reporting of environmental incidents. • Responsible for assessing risk of EP non-conformance of ECE impairments, consulting with the ECE Group Owner,to confirm appropriate prioritisation of repair based on risk of achieving relevant performance standards. Should there be a significant threat to ECE performance, the Environment team can advise for corrective maintenance to be classified as regulatory and subject to the deviation process, requiring Operations Manager approval for any maintenance deferral past LAFD. • Responsible for reviewing deviation requests to ensure performance standards and EP compliance are maintained. • Responsible for informing the S&E Manager to escalate issues to the leadership team should there be insufficient progress and support in the rectification and prioritisation of ECEs.
Vessel Masters	• Responsible for taking action immediately to rectify any environmental incident on the vessel. • Implementation of the EP on board the vessel. • Ensure effective operation of the vessel, taking into account relevant environmental aspects. • Communication of vessel environmental management activities on board. • Maintain administration of vessel's environmental management system requirements • Ensure all crew members comply with the EP. • Manage any spills per SOPEP. • Responsible for ensuring cetacean sighting recording is undertaken. • Maintain good housekeeping and cleanliness around the vessel. • Compliance with DAFF and other marine regulations.
Contract Holders	• Ensuring implementation of this EP for the contractor's scope of work. • Ensuring contractors have adequate environmental capability in order to execute their scope of work. • Reviewing and provide assurance over contractor environmental performance.

Title (Role)	Main Responsibilities/Accountabilities
All personnel	• Understand and comply with standards and procedures that apply to their area of work. • Immediate reporting of any environmental hazards or incident to the supervisor. • Understanding the environmental risks and controls applicable to work. • Following instructions from the OIM or supervisor with respect to environmental protection and measurement criteria outlined in this EP. • Undergo environmental training as required by role and activity. • Carry out assigned activities in accordance with approved procedures and the EP. • Stop any operation or activity that is deemed to present an unacceptable risk to the environment.

10.4 Competence and Inductions

10.4.1 Competency

All personnel required to work on Prelude FLNG and/or Crux shall be employed on the basis they are competent to carry out their role. However, there is a subset of the workforce whose roles and duties are critical to the safe running and management of the Prelude-Crux operations that they require Competence Assurance. These are people in HSSE Critical Positions (see Figure 10-2) who are directly responsible for the safety of operations.

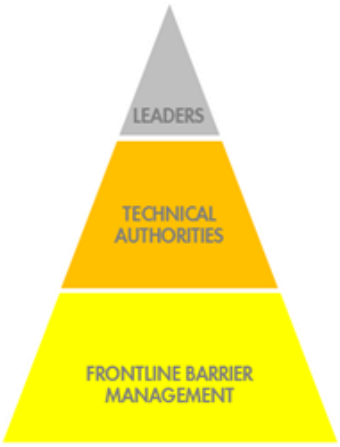


Figure 10-2: HSSE Critical Positions

Being competent within their role is essential for effective management and will form a key element of implementation of the activity whilst ensuring the best environmental outcomes. These positions include the following key roles and responsibilities:

- HSSE Critical Leader Positions
  - Senior Management Position at Leadership Team level with Operational, Technical and/or Engineering responsibilities with RAM red or yellow 5A or 5B risks (refer to Figure 10-4).
  - Operational, Technical or Engineering position responsible for defining ALARP for RAM red or yellow 5A or 5B risks for a project, technical department or asset.
  - Operational, Technical or Engineering position accountable for delivering ALARP for RAM red or yellow 5A or 5B risks for a major asset, group of small assets, major project or group of small projects.
- Technical Authority Level 1 and Level 2
  - Technical Authority Level 1 or 2 roles, which involve design, implementation and maintenance of barriers established for managing hazards with RAM red or yellow risks are deemed HSSE Critical (refer to Figure 10-4).
  - Required to be ‘Skill’ level at relevant technical and operational competencies.
- Frontline Barrier Management (FLBM)
  - Responsible for playing a critical role in ensuring that all safety-critical tasks and activities are carried out effectively. They are responsible for implementing and maintaining the effectiveness of all barriers identified (controls and recovery measures) for managing MAE and MEE hazards (as defined in Section 10.5.2) at the facility, including managing hazards with RAM red or yellow 5A or 5B risks (refer to Figure 10-4). These are mainly the roles played by production and maintenance technicians on the facility.

To supplement these, within Shell, the SEAM Standards require people in HSSE Critical Positions to have their HSSE-MS competence assured. These people must attain a set proficiency level in three competences:

HSSE Lead; HSSE Prepare; and HSSE Apply. People in HSSE Critical Positions are responsible for the development and maintenance of effective barriers to prevent incidents.

Personnel in HSSE Critical Leader positions are required to demonstrate the required level of competency in Lead, Prepare and Apply HSSE & SP Risk Management, subject to their Proficiency Profile. The HSSE critical leader positions are required to be skilled on the Lead, Prepare and Apply HSSE & SP risk management competency elements. Shell maintains a HSSE Critical Positions Register and HSSE Critical Positions have been identified and positional competency requirements have been defined according to the HSSE & SP and Asset Management Foundations Standard.

Shell has a defined set of Technical Authorities, from TA3 to TA0, with TA2 being a HSSE Critical position. Where a Technical Authority is not available within Shell Australia, access is available to the Shell Global Technical Authority pool. A list of competent Technical Authorities is maintained globally through the Discipline Authorities Manual (DAM).

The register assigns a HSSE profile to each role and defines required proficiency levels for each profile. After assessment of individual competencies against position requirements, proficiency gaps will be addressed in training and coaching.

Shell personnel and contractors working offshore require mandatory training as defined in the Competency Matrix (or equivalent naming convention). This matrix identifies the required HSSE and SP competence and training requirements for Shell staff (and contractors who carry out specific activities and duties. The training matrix is built around requirements from the Management System and Australian regulatory requirements. Visitors to the facility may have less stringent training/competency requirements as appropriate to the job tasks they are executing.

In terms of the vessel operators, only prequalified companies with whom Shell have a service agreement are qualified to bid for the activity. A HSSE pre-qualification questionnaire is included in the tender package, which is evaluated by the HSSE department in parallel to the technical and commercial evaluations. Contractors have their own competence requirements in place as described in Section 10.3.1. Training records of all personnel will be maintained, and the training program will be subject to review on a regular basis.

10.4.2 EP Onboarding

OPGGS(E) Regulation 14(5) requires that the EP implementation strategy must include measures to ensure that each employee and contractor working on, or in connection with, the activity is aware of their roles and responsibilities in relation to the EP.

All employees and contractors that mobilise to Prelude are required to complete HSSE SP onboarding prior to mobilisation to be aware of relevant obligations and commitments. In relation to the EP, this onboarding covers:

- Shell Australia HSSE and SP Policy and Commitment including SEAM standards
- Legislative requirements
- Ecological and socio-economic values of the project area
- Key environmental aspects, impacts and risks
- Shell's key EP Commitments
- Environmental management requirements, such as:
  - Liquid discharges management
  - Drainage system management
  - Emissions management
  - Chemical and hydrocarbon management
  - Waste management
  - Marine fauna interaction
  - Reporting of environmental incidents (such as spills)

- Emergency Response (including spill response).
- EP commitments (EPOs and EPSs) and environmental management requirements relevant to the majority; specific roles receive further engagement on relevant commitments as part of their role specific training.

Additionally, on arrival at the facility, personnel (including short-term visitors) attend an onsite orientation briefing, designed to familiarise them with the general operations and location of key areas. The orientation explains the site-specific safety, environmental and emergency response aspects. A log with signatures of all personnel to have completed this training will be kept ensuring compliance with Shells competency and induction standards and to ensure requirements are met. The log will be stored in a centralised database and the Safety and Environment Manager is responsible for maintenance, retention, and compliance.

10.4.3 Permit to Work (PTW)

The Permit to Work (PTW) process is used to control and approve work on the Prelude FLNG facility and within the Activity Area. It ensures that adequate controls and measures are in place to safeguard people, asset and environment from work activity hazards. Details of the PTW process are described in the Permit to Work Manual and electronic PTW administration system.

The objective of the PTW system is to create a safe working environment by controlling any hazards that may arise from a task, from the planning phase, right through to execution and handback. The PTW system ensures that all activities planned or undertaken on Prelude are properly planned, risk assessed, controlled/approved, coordinated, communicated, and safely executed in accordance with Shell's policies, procedures, government regulations, industry standards and to the SEAM Standards. The PTW process ensures that:

- All work is clearly defined and authorised
- The scope of work to be carried out, the risk level and the category of work (hot, cold, etc) is clearly defined on the permit form
- Persons authorised to work are trained and competent in their scope
- An appropriate level of hazard identification and risk assessment is carried out in keeping with ALARP principles for all activities.

Activities requiring a permit fall within one of the following defined permit types in Permit Vision and are subject to the Prelude Permit to Work requirements:

- Cold Work
- Mechanical
- Instrument and Control
- Industrial Cleaning
- Radiation
- Excavation
- Working at Height (including work over water/work of the side)
- Electrical
- Lifting and Hoisting
- Drilling/Well services
- Confined Space
- Breaking Containment
- Hot Work

Permits are classified based on the level of risk associated with the specific job for which the permit is to be issued. The permit may specify mandatory controls according to the hazards associated with the task.

Most activities on Prelude FLNG require a permit, however, there are standard operational and marine operations activities that do not require permits and are managed through approved procedures. Execution of these activities is allowed only after safety and environmental precautions have been put in place.

10.3.4.1 Permit to Work Roles & Responsibilities

Persons authorised to plan, prepare, authorise, and carry out work activities are trained and competent in their field. Specific roles and responsibilities are defined to ensure work is controlled according to the PTW process, these are described in Table 10-4.

Table 10-4: Key Role and Responsibilities within the Permit to Work Process

Role	Responsibilities
OIM	Accountable for the safe and effective use of the PTW system on Prelude.
Permit Requester	The person who applies for a PTW to do the work, identifies the hazards and proposes the controls.
Permit Verifier	The person responsible for reviewing the permit draft and ensuring that it is complete and correct, and potential hazards have been identified, and the defined controls are sufficient for the work scope.
Permit Authoriser	The person responsible for authorising the permit. The person able to fill this role is dependent on the risk associated with the permit.
Permit Issuer	The person responsible for ensuring that all preparations are complete and for issuing the PTW for the work to proceed.
Permit Holder	The person responsible for carrying out the work in accordance with the conditions of the PTW.
Area Authority	The person in charge of a specific area – they are responsible for permits and the management of conflicting work in their area.
Responsible Person Electrical	The person who approves PTW involving electrical works. The focal point for the safe day to day control and operation of electrical systems.
Isolation Owner	The person who designs the isolation draft, applies the isolation (including locks and tags) and removes the isolation in the field.
Isolation Verifier	The person who verifies the content of the Isolation Confirmation Certificate.
Isolation Authoriser	The person who authorises execution of the planned isolation.
Isolation Deviation Manager	The Isolation Deviation Manager who signs to approve an isolation when it does not meet the standard as directed by the Isolation Workflow.

The PTW system has eight key steps which must be followed, these are:

- Define work scope, hazards and controls
- Verify work scope, hazards and agree controls
- Authorise planned work
- Review/verify controls in field
- Issue permit
- Pre-job discussion
- Execute and supervise
- Verify job complete and hand back.

Following the above steps ensures that all work carried out is fully risk assessed for the project and environment and aligns to ALARP.

Shell has implemented an electronic PTW system called Permit Vision. There is high-level redundancy built into the tool, however, the facility is equipped with a paper-based back-up system. The electronic PTW system allows for continuous monitoring of implementation and performance to aid further development and improvement of the PTW process with a view to safeguarding environment, asset and people.

10.4.4 Management of Change (MOC)

It is a Shell requirement for assets to perform effective Management of Change (MOC). The formal process of MOC aims to ensure that all effects from an applied change are identified and their impact to the asset considered holistically. The importance of MOC is highlighted by the appointment of an individual who is accountable for the MOC process, governance, and its effective implementation. The Shell Australia Management of Change Manual implements the process, which is designed to provide assurance that new risks are not knowingly incurred when changes are introduced, or the prevailing risk profile is not adversely changed without appropriate mitigation.

Change can be permanent, temporary, or emergency in nature and cover the following type of changes:

- Process Changes (Hardware, Process Control, Process Conditions)
- Procedural Changes that affect HSSE Critical Content
- Organisational Changes (Shell and Contractor) impacting HSSE Critical Roles.

The MoC Manual is supported by specific procedures, templates and checklists and monitored through an electronic MoC system. The process is built around seven simple steps forming an overarching governance framework (Figure 10-3).

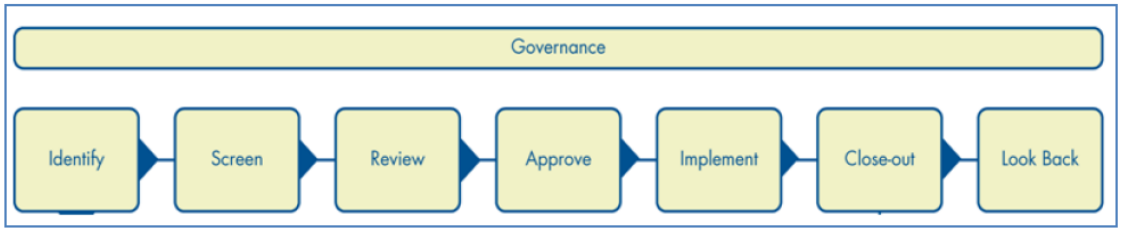


Figure 10-3: Shell Australia Management of Change Steps

Key elements of the MOC process are:

- Change is recognised and the relevant MOC process is applied to that change. A change does not need to follow the MOC process if it is a change in-kind (i.e. replacement of a piece of equipment for an identical replacement).
- Hazard Identification (HAZID) and risk assessment is done on every change to identify the impact of the change and to ensure that appropriate additional controls are implemented to reduce the risk to ALARP.
- Changes are reviewed by the appropriate personnel as defined in the Change Approval Authorities Matrix. Reviewers must be satisfied that sufficient information is presented, good design practices have been followed and that the final design is operable, maintainable, and reliable.
- Changes are approved as defined in the Change Approval Authorities Matrix. Approval of the change means that the MOC Approver is satisfied that the scope and impacts of the change are understood, the hazards are identified and mitigated (where appropriate), that the overall benefit of implementation the change outweighs the risk(s) and that all changes are authorised prior to implementation.
- Changes are authorised as defined in the Change Approval Authorities Matix. Authorisation is the last step prior to the change ‘going live’ after ensuring that the change is as per the MOC and that the relevant readiness reviews have been completed.

The following scenarios may also trigger the review of the management of a particular environmental impact or risk to ensure that ongoing management of impacts and risks are at ALARP and Acceptable levels:

- Changes in regulatory requirements/standards
- Information which may suggest an increase in environmental risks or impacts to those outlined in the EP
- Prominent new scientific studies which may 'negatively' change the understanding of environmental risks and impacts
- Objections or claims raised which require changes in EP content following the process outlined in Section 5.

The screening process for all new changes (hardware or software) require assessment of HSSE & SP aspects. This may result in a change being flagged to comply with Section 38 and 39 of the OPGGS(E) Regulations. If a change is considered significant as determined by the MOC process, then a revised or new EP will be submitted to NOPSEMA for acceptance. Minor EP revisions will not be submitted to NOPSEMA for formal assessment unless they trigger an EP revision against the OPGGS(E) Regulations.

The Shell MOC process complies with the SEAM Standards.

10.4.5 Managing HSSE and SP Risk

The purpose of Managing HSSE and SP risk is to identify HSSE and SP hazards and to reduce the risks to ALARP. The Hazards and Effects Management Process (HEMP) is used to manage HSSE & SP risks to ALARP in assets. It is complemented by additional SEAM Standards, which are themselves complemented by practices, such as the HSSE Critical Equipment (Section 10.5.2) and HSSE Critical Human Barrier requirements. The HEMP process allows the business to be explicit in how it manages and assures the effectiveness of the barriers in place to address Risk, especially Risks in the Red or Yellow 5A or 5B areas of the RAM. Refer to Figure 10-4 for the RAM.

Severity	Consequence				Increasing Likelihood				
					A	B	C	D	E
	People	Assets	Community	Environment	Never heard of in industry	Heard of in the industry	Has happened in the Organization or more than once per year in the industry	Has happened at the M location or more than once per year in the Organization	Has happened more than once per year at the Location
0	No injury or health effect	No damage	No effect	No effect					
1	Slight injury or health effect	Slight damage	Slight effect	Slight effect					
2	Minor injury or health effect	Minor damage	Minor effect	Minor effect					
3	Major injury or health effect	Moderate damage	Moderate effect	Moderate effect					
4	PTD or up to 3 fatalities	Major damage	Major effect	Major effect					
5	More than 3 fatalities	Massive damage	Massive effect	Massive effect					

Figure 10-4: Shell Risk Assessment Matrix (RAM)

10.4.6 Chemical Management Process

The Shell Chemical Management Process and Shell Global Product Stewardship Guidelines are used to assess chemicals that may pose environmental impact via planned discharges. All chemical applications are required to be screened in accordance with Shell Global Product Stewardship guidelines (Figure 10-5).

Where chemicals may be discharged to the marine environment preference is to select those chemicals that are deemed environmentally acceptable (PLONOR, Gold, Silver, D and E) with no substitution warning under the Offshore Chemical Notification Scheme (OCNS). Chemicals that fall within this banding require no further assessment and are deemed ALARP and acceptable.

This approach ensures that environmental risks associated with chemical discharges are reduced to As Low As Reasonably Practicable (ALARP) and remain compliant with applicable Commonwealth legislation. Consideration is given to the schedule to which each chemical has been assigned under IChEMS, and all associated requirements are adhered to across the chemical lifecycle, including manufacturing, import/export, use, storage, and disposal, within Australia.

Following the chemical management process (Section 10.4.6) together with compliance with the ICEMR Act and the Register Instrument, minimises the impact of chemicals used and discharged to ALARP levels.

For chemicals outside of the OCNS or which fall outside of the preferential banding (PLONOR, Gold, Silver, D and E with no substitution warning), Shell follows a three-step process and hierarchy of controls to support decision making:

- **First**: Try to eliminate use of product – If unable to eliminate use of product proceed to step 2
- **Second**: Try to substitute with a product of lower risk
- **Third**: Ensure that risks can be managed.

If no alternative is technically or feasible suitable, the chemical is required to be assessed via Shell Global Product Stewardship guidelines and ALARP demonstration with risk reduction control measures (Figure 10-7). Approval will be provided by the Shell Production Chemist/Product Steward Focal Point. Chemicals that are not deemed ALARP will be not approved, and an alternative product shall be requested.

To ensure that chemicals which may pose impact to the marine environment are managed appropriately on an ongoing basis, annual compliance checks will be made by Shell and chemical vendors of Shell's Chemical Treatment Program Guide and Chemical Risk Assessment Register. To accompany routine compliance checks, the impact of chemicals in key discharge streams will be assessed on an ongoing basis as indicated in Figure 10-6.

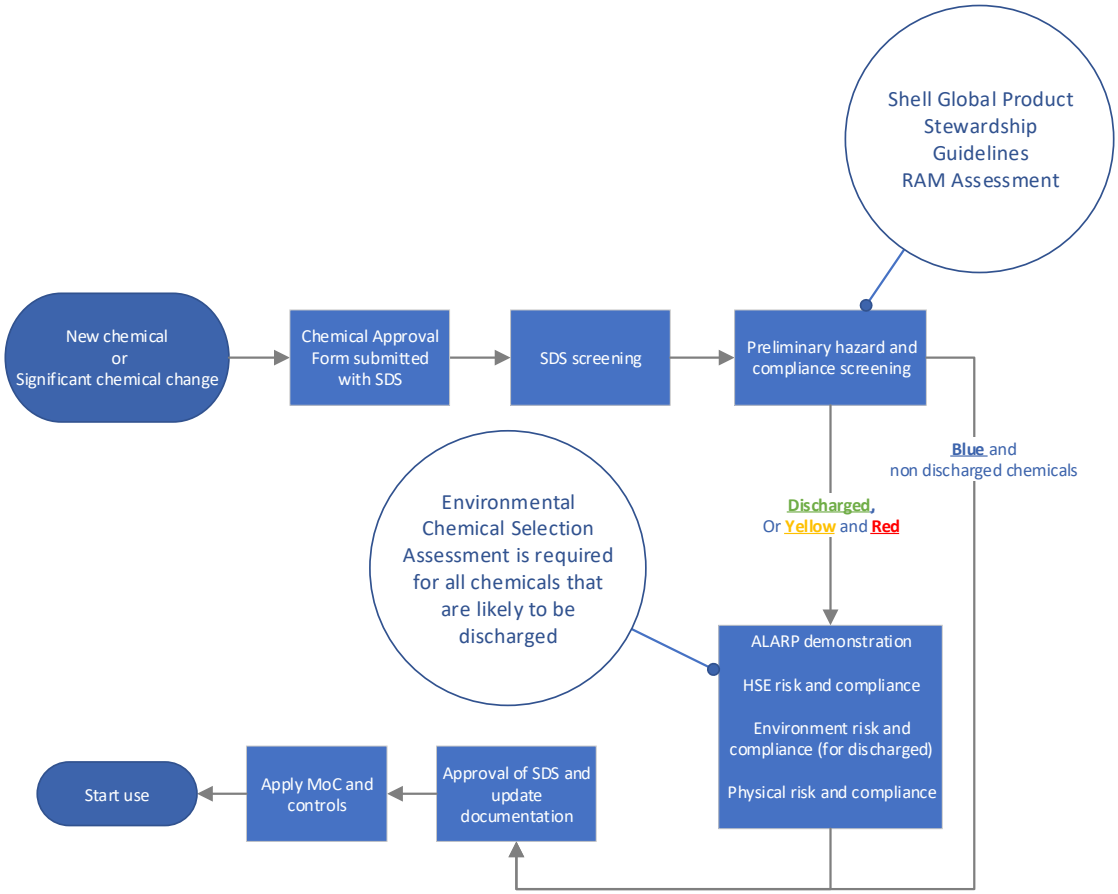


Figure 10-5: Chemical Approval Process

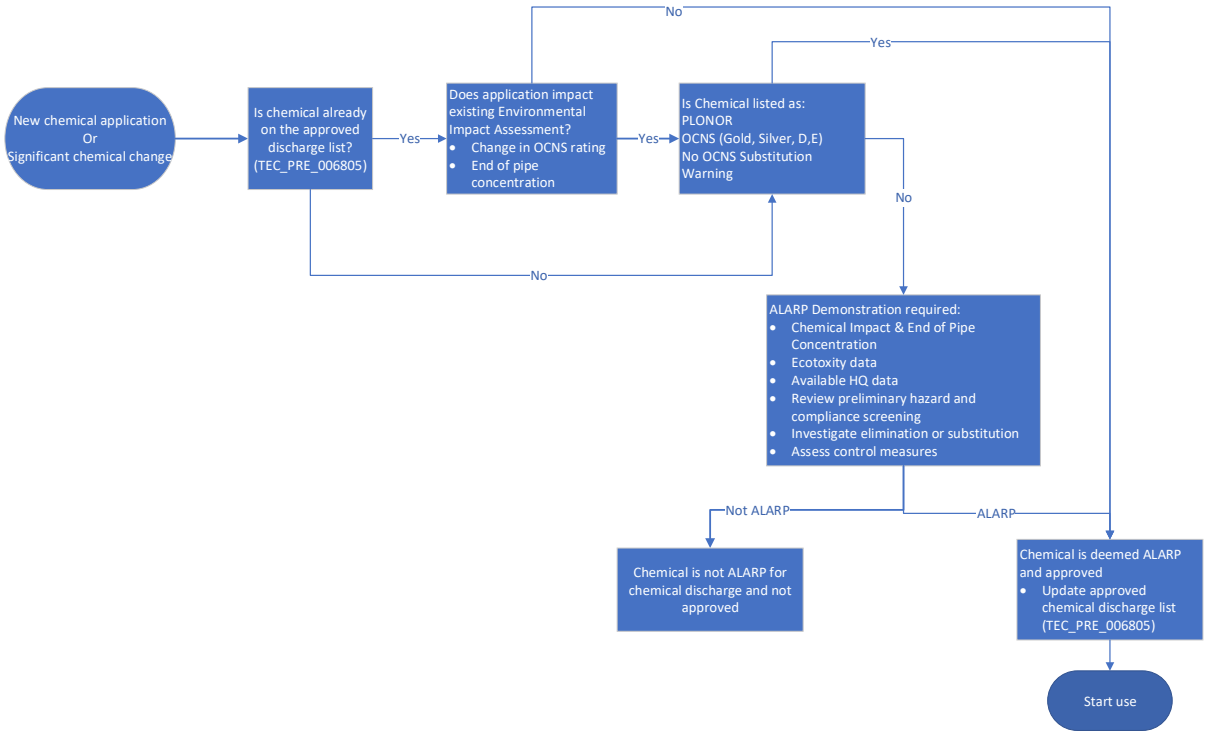


Figure 10-6: Environmental Chemical Impact Assessment

10.4.7 Manage Information, Data and Systems

This objective is to create an accountable role in the Asset which can look across operational work processes to ensure consistency in information and data management practices; support data centric culture development through best practice sharing and Assurance activities. The process evaluates maintenance and production practices to ensure there is an integrated approach to critical information management and data required to fulfil the business outcome and manage asset risks.

10.5 Process Safety and Asset Management

The Process Safety and Asset Management SEAM Standard encompasses a range of standard practices. A selection of these critical to Prelude environmental management in the context of process safety and asset management are summarised in this section. Implementation of these practices ensures that Prelude is operated and maintained in a safe and environmentally responsible manner and realises the benefits of a globally proven management system.

10.5.1 Asset Integrity & Process Safety Management

Shell uses the Asset Integrity & Process Safety Management (AIPSM model), as shown in Figure 10-7, to describe the key focus areas of process hazard analysis and process safety management which is also critical for EP implementation. The key focus areas include:

- **Design Integrity –** to design and build assets so that risks are ALARP.
- **Technical Integrity –** apply barrier to manage identified MAEs and MEEs. Ensure these barriers (SCEs and ECEs) are maintained to keep them effective.
- **Operating Integrity –** processes ensure that the facility is being operated within its design envelope.
- **Integrity Leadership–** leadership is integral in safeguarding against process safety and environmental incidents and must demonstrate visible and felt leadership in the field.

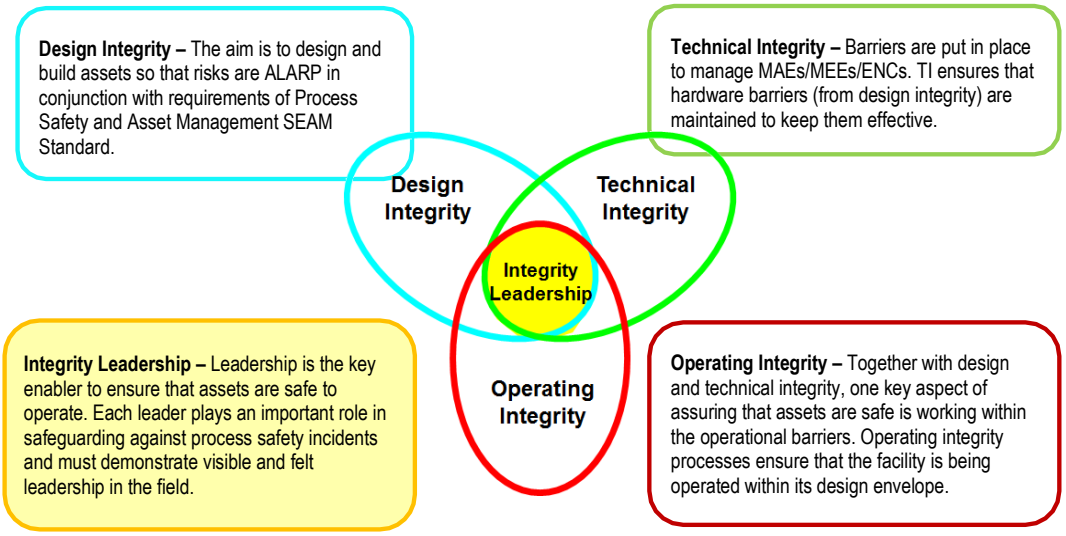


Figure 10-7: Shell AIPSM Focus Area

10.5.2 Environment Critical Equipment Management

To apply AIPSM to environmental management, environmental risks and impacts are identified in process hazard analysis or risk reviews such as HAZID, Environmental Impact Identification (ENVID) or Hazard and Operability (HAZOP) workshops. These workshops are conducted with the assistance of a multi-disciplinary team to ensure a systematic and methodological approach to identifying potential environmental impacts and risks which are then recorded in project registers. Once the risks and impacts are identified, mitigation is considered, in line with the hierarchy of controls, and with the aim of ensuring risks and impacts are both acceptable and minimised to ALARP. A subset of the hazards is subjected to additional review to enable subsequent preparation of technical integrity performance standards. These subsets are defined as:

- Major Accident Event (MAE) – those hazards which are assessed using the Shell Risk Assessment matrix (RAM) to be Red or Yellow 5A/B to People. In addition, under the OPGGS (Safety) Regulations, an MAE is an event connected with a facility, including a natural event, which has the potential to cause multiple fatalities of persons at or nearby the facility. Therefore, for Prelude, an MAE has been defined as a hazard with the potential to cause multiple fatalities or is risk assessed as RAM Red for People.
- Major Environmental Event (MEE) – those hazards which are assessed using the Shell Risk Assessment matrix (RAM) to be Red or Yellow 5A/B to the environment. MEEs relating to loss of containment may often align to an equivalent MAE (hence defined below as the subsequent critical elements are managed accordingly).
- Environmental Non-Compliance (ENC) – those hazards defined as an environmental legal non-compliance (breach of a performance standard committed to in the Environment Plan) and are thus recordable, or reportable, incidents to the regulator.

Using process hazard analysis tools such as bow tie assessment, a multi-disciplinary team identifies Environmental (or Safety) Critical Elements (ECE or SCE) for each of the MEEs, ENCs and MAEs. Any MEEs that are equivalent to an MAE are subsequently managed by the SCE process. An ECE is defined as an item of equipment or structure whose failure could lead to the release of a major environmental hazard or whose purpose is to prevent or limit the consequences of a major environmental hazard (RAM Red or Yellow 5A/5B Environmental risks); or environmental regulatory non-compliance as part of implementing the controls to manage environmental hazards to ALARP and Acceptable levels.

Identification of ECEs, and assurance of their implementation effectiveness is an important element of ensuring that ECE groups will function as required. ECE identification was undertaken through the following steps:

- review of the Environment Plan and Shell Commitments register for all system regulatory requirements.

- defining potential regulatory non-compliances relevant to plant and maintenance.
- review of Process Flow Schemes (PFS), Process Engineering Flow Schemes (PEFS) and HAZOPs for units to identify failures that could lead to a regulatory non-compliance; and
- documenting safeguards, barriers and equipment that protect against a regulatory non-compliance.

The following ECE groups have been identified and Performance Standards for these have been developed:

- ECE-DS1 - Oil in Water Discharge Detection (Produced water)
- ECE-DS2 - Oil in Water Discharge Detection (Bilge water)
- ECE-DS3 - Oil in Water Discharge Detection (Slops MARPOL water)
- ECE-DS4 - Chlorine Off Specification Emission Detection
- ECE-DS5 - Emissions Monitoring Flare and Vent
- ECE-DS6 - Emissions Monitoring Boiler System
- ECE-DS7 - Emissions Monitoring Diesel
- ECE-DS8 - Emissions Monitoring Product Throughput
- ECE-IC9 - Flare Tip Ignition System.

The roles and responsibilities associated with the identification of ECEs, development of functional criteria, and management to achieve the defined performance standards is detailed in the Prelude Operate ECE Performance Standards document.

An ECE group owner develops the Performance Standards for their ECE barrier, which typically consists of an ECE goal, functional criteria, minimum assurance task, assurance measures and required activity upon impairment of ECE. These form part of the maintenance strategy for the equipment, which is integrated into the Computerised Maintenance Management System (CMMS). The performance standards are reviewed with the Environment team to ensure that the functional criteria achieves the level of performance required by the EPS, and that the defined maintenance plans sufficiently support the function of the equipment. The completion of preventative maintenance assurance tasks are managed through CMMS and monitored through the Facility Status Reporting (FSR) tool, which displays work order status according to barrier and group allowing for the timely completion of maintenance. When environmental impairments are raised, the Environment team review the corrective maintenance notification with the ECE Group Owner to confirm criticality, enabling suitable prioritisation of the repair to return the control to full function in a timely manner. Impairments with a risk of performance below the associated performance standard may be classified Regulatory for prioritisation and be subject to the deviation process, requiring approval from the Operations Manager to defer maintenance past its Latest Allowable Finish Date (LAFD).

Table 10-5 lists the key tools that are to be used on Prelude to manage ECE (and SCE) hardware barriers. If a critical element fails to meet the criteria specified in the ECE Performance Standard and cannot be remediated immediately it may be classified as an ECE impairment. If an ECE is damaged but its ability to meet the required ECE performance standard is not impacted (e.g. damage to a critical analyser but it continues to perform valid measurements), then is not considered to be an ECE impairment. If an ECE impairment arises:

- A corrective maintenance work notification must be created in CMMS for the repair of the ECE. The repair of the ECE will be managed through the corrective maintenance process/Perform Maintenance Execution (PME) process (Section 10.5.2).
- The ECE impairment and its corrective maintenance work order will be visible through the Facility Status Report (FSR) tool (see Table 10-5).

Table 10-5: Technical Integrity Management Tools

Tool	Name	Function
CMMS	Computerised Maintenance	Contains Prelude Asset Register with ECEs.

Tool	Name	Function
	Management System	Maintenance work planning, scheduling, and execution management. Documentation of completion of maintenance work. Business Warehouse function for maintenance KPI reporting and analysis. Quality module for analysis of maintenance work. Integrated with other business systems for purchasing, materials management, finance, and logistics.
AMS	Asset Management System	A set of processes which are part of SEAM standards needed to organise asset management capabilities, ensuring that activities are performed consistently and systematically. Includes mandatory elements (through Standards and Manuals) and non-mandatory elements (through Recommended Practices) and used in conjunction with other SEAM Standards. The Asset Manager is accountable for ensuring adherence to the AMS. The AMS standard provides all the tools and processes which help an asset get to at least the minimum requirements comprising four major sections: 1. Leadership, Commitment and Accountability. 2. Requirements Processes and Guides. 3. Organisational Capability. 4. Learning Loops.
IMSA	Integrity Management System Application	Integrity management software for pipelines (both onshore and offshore) and underwater assets (apart from wells).
FSR	Facility Status Report	Status of preventive maintenance and corrective maintenance work orders and deviations, as well as the tool to manage the MOC process
ACP	Asset Care Plan	The primary purpose of the ACP is to provide the integrated view of activities required to keep Prelude operating safely and reliably for the long term.
eWIMS	Wells Integrity Management System	Electronic online system for the management of wells specific integrity tasks. Interfaces with CMMS for scheduling and status of tasks (as CM or PM work orders)

10.5.3 Process Safety Requirements

Process safety requirements are integral to the environmental hierarchy of controls and ALARP demonstration, as they relate to loss of containment of hydrocarbons and hazardous materials. Shell Group applies Design and Engineering Practices (DEPs) when designing or constructing new assets or making any modification to an existing asset. The DEPs applies to all Shell assets/projects that have RAM red or yellow 5A or 5B process safety risks and set mandatory design and construction requirements and include consideration of industry standards, industry learnings from major process safety incidents and regulatory expectations in geographies in which Shell operates.

The DEPs are part of the Design and Engineering Management (DEM) process within the SEAM Framework. In addition to the DEM, another key component of the SEAM Standard is the Statement of Fitness (SOF) practice which provides sufficient assurance to operations that the new asset, or modification to the existing Asset, is handed over in compliance with the applicable process safety requirements. A SOF is a cross-functional review to confirm integrity and ensure that controls are in place and effective (process safety risks managed to ALARP) to begin or continue operation of a process or equipment.

Assets are also required to verify, assure, and validate technical integrity in design and construction (including brownfield projects or modifications). Process Safety Information is maintained to manage process safety risks, and this typically includes (but is not limited to) design basis; process engineering flow schemes; piping and instrumentation diagrams; cause and effect diagrams; alarm documentation, plot plans, layouts, area classification drawings; specifications, datasheets; operating procedures and training records.

10.5.4 Application of Technical Standards – Design Engineering Management 1

The Shell Group Design and Engineering Publications (DEPs) form the basis of all detailed design and are applied over and above the regulatory minimum. These documents are owned and managed by Shell Projects and Technology, the Shell Group's technical service organisation, and are under continual review as experience and knowledge grows through operation around the world. The documents embody the most up to date knowledge within Shell Group on a wide variety of design and engineering tasks. Where applicable, the DEPs have been aligned with internationally recognised Industry Standards.

A subset of DEPs contains process safety related design requirements. These DEPs form what is known as the Design Engineering Management 1 (DEM1). Compliance with the 'SHALL' requirements is mandatory for all new projects and equipment. A deviation process that includes a demonstration that ALARP will be achieved is required to be followed if an alternative solution is to be used. The ALARP demonstration is assessed by relevant Subject Matter Experts, including personnel external to the facility. Accepted deviations are filed on a central Shell Group register.

10.5.5 Process Safety Basic Requirements – Design Engineering Management 2

Design Engineering Management 2 (DEM2) contains a set of Process Safety Basic Requirements (PSBR). The intent of the PSBR is to prevent a re-occurrence of known major Process Safety incidents by focussing on their main causes and key barriers. Examples include:

- ESD valves on platform risers (Piper Alpha 1988)
- Avoid liquid release relief to atmosphere (BP Texas City 2005)
- Low Temperature Embrittlement (Longford 1998).

The PSBRs contain both design and operational requirements. Application of DEM2 requirements is mandatory. Any Shell Group project or asset must demonstrate alignment to these PSBRs or otherwise follow a rigorous derogation process requiring the signature of the Shell Group Chief Executive Officer. There have been no DEM2 derogations required for the operation of Prelude.

10.5.6 Ensure Safe Production

The Ensure Safe Production work process provides a structured framework by which an asset can operate cost-effectively within safe and optimal limits without compromising its integrity or reliability while maximising production, reducing deferment, and minimising HSSE impacts and risks to ALARP and acceptable levels.

Ensure Safe Production process scope consists of these five areas further outlined in Figure 10-8 below:

- **Ensure Plan Delivery** by establishing routines and activities to maximise value and deliver Production Plan through analysis, optimisation and resolution of issues that threatens delivery of the plan.
- **Situational Awareness** by the shift team gaining full understanding of the facility during shift and crew handover through standardising communications and planning across operations shifts. It is important that teams understand what is needed to operate safely, reliably, and optimally.
- **Manage Limits and Alarm** by ensuring that facilities are operated within approved operating limits, a healthy alarm system is maintained and there is reliable operator response to alarms. Process conditions leading to alarms are managed to stabilise operations, minimise control room distractions and promote effective response to abnormal situations. Effective alarm and target management leads to improved business outcomes.
- **Proactive Monitoring** through early detection of threats or opportunities by carrying out structured monitoring of process and equipment which enables facility team to 'find small, fix small' leading to sustained optimal operations and minimised process safety and reliability risks.
- **Managing Abnormal Situation** through recognising and responding to any deviation in the production process in a structured way and bringing the situation back to normal in a controlled way. Through stabilise, slowdown and shutdown process safety, reliability risks, limit exceedances or other developing process threats that may impact overall integrity of the facility can be minimised or eliminated.

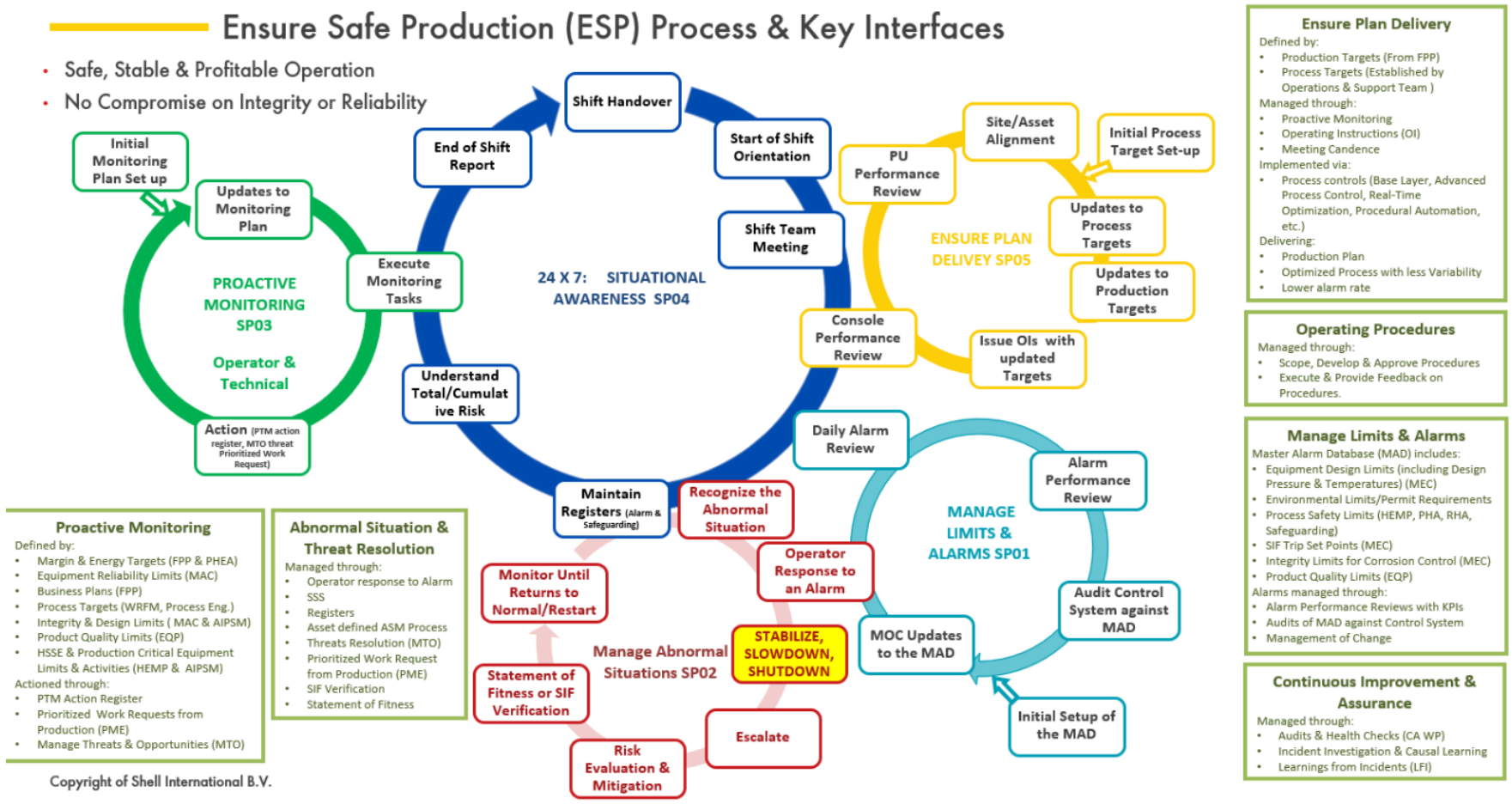


Figure 10-8: Ensure Safe Production Process Overview and Key Interfaces with Other Processes

10.5.6.1 Proactive Technical Monitoring

A Proactive Technical Monitoring (PTM) process is in place to ensure early detection of threats through structured proactive monitoring of process and equipment, which will enable the ability to 'find small, fix small' leading to sustained optimal operations and minimised risks. PTM includes monitoring for identification of short-term threats, as well as monitoring longer-term or cumulative threats and is applied for the management of produced water discharges and oil in water limits, and other applications as required such as flare monitoring and fuel gas consumption.

Figure 10-9 shows how the proactive technical monitoring integrates across other key SEAM standards work processes which are key to good environmental management. Perform Well Reservoir Facility Management (WRFM) is further detailed in section 10.5.12.

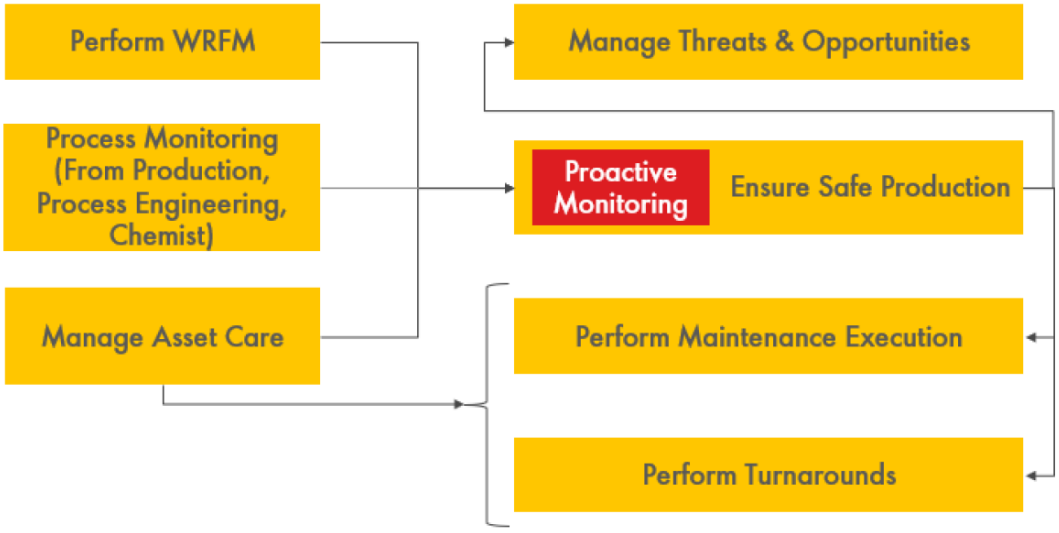


Figure 10-9: Integration of Proactive Monitoring across the SEAM Standards Work Processes

The key process activities of Proactive Monitoring shown in Figure 10-10 are:

- Create and deploy monitoring plans aligned with Equipment Care Strategies
  - Gather data
  - Define the care strategies for equipment and process
  - Determine monitoring approach
  - Complete additional set-up for Exception Based Surveillance
  - Finalise and deploy monitoring plans
- Execute monitoring
- Respond to exceptions:
  - Analyse (vet out false positives and false negatives)
  - Diagnose (deeper technical analysis to come with a recommendation)
  - Action recommendations
- Update the monitoring plan (continuous improvement cycle).

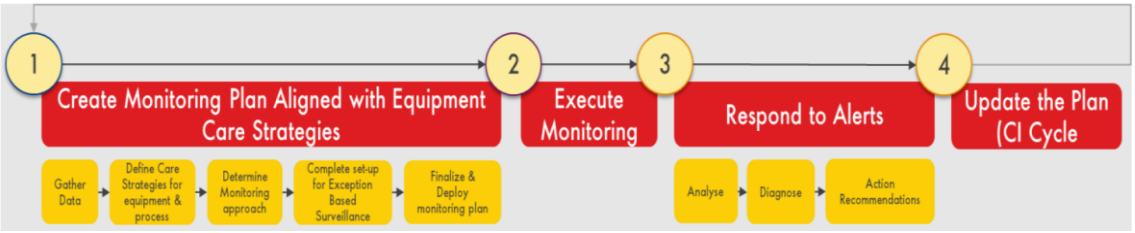


Figure 10-10: PTM Work Process – Key Steps

10.5.6.2 Managing Abnormal Situations

Managing abnormal situations involves recognising and responding to any deviation in the production process in a structured way and bringing the situation back to normal in a controlled way. The operator is mandated and expected to Stabilise, Slowdown or Shutdown the facility to ensure the safety of staff and the safe operation of the facility. Figure 10-11 shows the range of production limits the abnormal situations process covers.

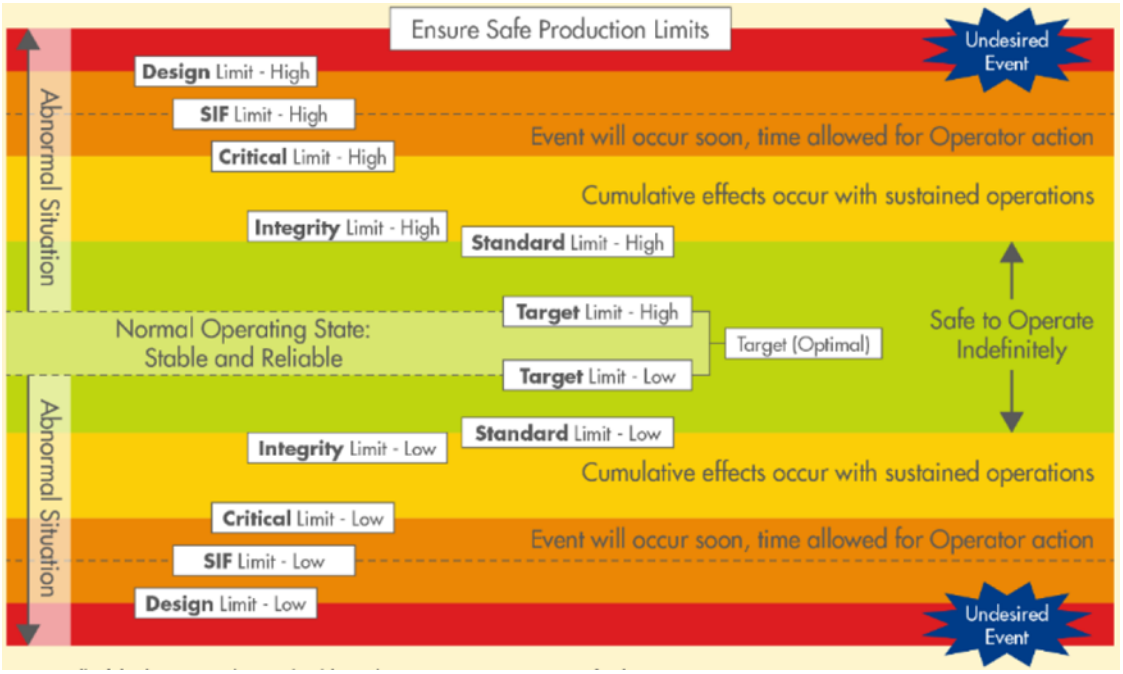


Figure 10-11: Ensure Safe Production Limits

10.5.6.3 Situational Awareness

Situational awareness addresses the effective handover of operational responsibilities from the outgoing shift team or crew to the incoming shift team or crew, verify the handover, and familiarise them with the current condition of the Asset. The situational awareness of the team/crew is increased by evaluating information obtained from Shift Handover and the Start of Shift Orientation (SoSO) in the Shift Team Meeting to determine the current Shift Plan. Each team member documents events as they occur during the current shift in the End of Shift Report.

The SoSO is a time bounded, initial familiarisation of the Asset generally performed between shift handover and shift team meeting (except for geographically dispersed locations which perform the SoSO after the shift team meeting.) The SoSO is meant to confirm the status of the Asset matches what was heard during the shift handover and prepares the individual to contribute to the shift team meeting.

10.5.7 Design and Operating Envelopes

The Prelude facility has been designed and built to ensure that the risks associated with process safety events have been managed to ALARP. This is part of the ‘design integrity’ focus areas of AIPSM.

Design limits define the boundary of the design envelope for each piece of equipment and if exceeded could potentially lead to a loss of containment. These limits (such as pressure, temperature, and level) have been set using industry and company standards and assured via various process safety reviews (such as HAZOP and desktop safety reviews). Design limits should never be violated as this puts the mechanical integrity of the system at risk which could result in a critical failure of equipment and an increased risk to environment.

The safeguarding envelope sits between the operating and design limits. Where appropriate, automated safeguarding (trips or mechanical devices) have been implemented to prevent the design envelope being breached.

The operating envelope identifies the integrity, capacity, and performance constraints of a system. The operating envelope is within the boundary of the design envelope. The operating envelope should not be violated – it is Operations' responsibility to operate within the limits and boundaries of the operating envelope. Figure 10-11 provides an overview of the relationship between design and operational envelopes. Failure to operate responsibly within the design limits risks a loss of containment and potential environmental and safety risk increase.

Systems onboard the Prelude FLNG facility take live plant data and pre-defined envelopes (Design, Safeguarding, Envelopes and Operating Windows) to determine how a particular piece of equipment or process is operating. Alerts are directed to the relevant engineer and indicate which envelope the equipment is operating in and how it has been operating (and if there are faults). This allows for quick identification of where issues may lie and can be used to predict future exceedances. These alerts are reviewed by engineers frequently, and findings or required actions are fed back to the Operations team.

Changes to design and operating envelope limits must go through the MOC process.

10.5.8 Manage Asset Care

Implementation of the Manage Asset Care standard ensures that Prelude is in a position for the facility to operate in a safe and environmentally responsible manner and realise the benefits of a proven maintenance execution process that is of a global standard. The standards cover excellence in maintenance execution which transcribes to 'the right job, by the right person at the right time'; i.e. jobs and processes that are approved, scoped, performed with the right competency and attitude, scheduled to be performed at a time that reflects the needs and risk of the business and that asset. The manage asset care standards are designed to ensure the safe and reliable operation of assets, minimising risks, and maximising performance.

Prelude records Corrective Maintenance within the Computerised Maintenance Management System (CMMS). An Asset Register (section 10.5.8.1) is developed and maintained within the CMMS for maintainable equipment, allowing for auditable recording of preventative and corrective maintenance on equipment within the scope of work process on an as needs basis. Equipment care strategies are developed, which includes:

- Preventative Maintenance Library (PML) which defines planned tasks for the care of asset equipment using a risk-based approach to set optimal tasks that deliver business results.
- Maintenance Plan within CMMS that will gather data and analysis information and undergo reliability reviews to cover preventative and corrective maintenance.

Effective manage asset care execution contributes to the longevity, reliability and environmental safety and performance of Shell's assets.

The Asset Engineers maintain a structured approach for proactively reviewing findings from completed tasks, analysing data and results and implementing continuous improvements to the equipment care tasks (scope and frequency).

A key deliverable of the Manage Asset Care (MAC) process is the development of Equipment Care Strategies (Tasks) which are based on the insights from risk and consequence based methodologies such as Reliability Centred Maintenance (RCM), Risk Based Inspection (RBI), Safety Instrumented Systems (SIS). The Asset Care Plan (ACP) provides the integrated view of the activities required to keep Prelude operating safely and reliably for the long term. It does this by reviewing all the planned Equipment Care Strategies for each piece of equipment and optimising their delivery across the asset (against both cost and risk appetite of the asset).

10.5.8.1 Asset Register

The Asset maintains up to date information to make risk-based business decisions in an Asset Register. The Asset Register meets the minimum data standards requirements outlined by Manage Information, Data and Systems SEAM process (refer HSSE and SP and Asset Management Foundations Practices, Section 10.3). The Asset Register supports future maintenance activities and satisfies the decommissioning and removal obligations and makes allowance for changes in asset management requirements and planning throughout field life for both temporary and permanent equipment.

10.5.9 Perform Maintenance Execution

Perform Maintenance Execution (PME) SEAM processes ensure corrective and preventative maintenance tasks are scheduled, planned, and managed using work orders in the CMMS. All corrective maintenance entered in the CMMS are prioritised by the relevant discipline engineers using the Manage Asset Care Process. Continuous improvement in the PME process is managed through performance metrics tracked on a weekly, monthly, and quarterly basis. Additionally, feedback loops are utilised in the Close Work and Improve Performance phase of the PME Process, to initiate, implement and drive process improvements. Throughout the process, there is ongoing collaboration with other disciplines to ensure seamless interfaces and allows optimisation of process outputs.

A Corrective Maintenance (CM) notification is raised automatically to address failed assurance tasks. CM notifications are raised whenever a failure or impending failure is identified. All CM notifications are prioritised for execution using the Corrective Management Prioritisation Tool (CMPT). The CMPT assessment is done initially by Offshore Maintenance and Production Operations Team Leads, and then validated by the Operations Maintenance Coordinator, in collaboration with relevant stakeholders (as and when required). The CMPT considers consequences to People, Asset, Environment and Reputation and the likelihood of those consequences occurring. During the review of newly identified corrective work and when considering the risk, this is done with the mindset of managing risk to ALARP and any mitigation is considered to this standard. Once the priority is set and the notification is approved the Latest Allowable Finish Date (LAFD) for the corrective intervention is locked. Timely completion of maintenance, in advance of the (LAFD) enables completion of the intervention prior to the realisation of consequences occurring.

Once the notification is approved a CM work order with the defined Latest Allowable Finish Date (LAFD) can be created, planned, scheduled, and executed. Maintenance schedules are developed based on the capacity to liquidate work, with the expectation that work teams are 100% loaded for the week. The schedule is built incorporating (in this order) carry-over work from the previous week, PM work and CM work, with an emphasis on bringing in HSSE critical work, then based on priority and LAFD dates. The schedule is built in collaboration with Operations to ensure that equipment can be made available and is ready for maintenance when required.

10.5.10 Perform Hydrocarbon and Energy Accounting

Prelude is designed and operated to sustain accurate accounting for material balance, production allocation, energy consumption and GHG emissions. This accounting framework supports the continuous improvement process for optimising energy efficiency and GHG emissions improvement detailed in Section 10.7.

10.5.11 Perform Turnarounds (Maintenance Shutdown)

Prelude has a long-term turnaround strategy in accordance with this SEAM process to enable safe, effective, and consistent implementation of turnarounds to maximise equipment safety, reliability, and availability and form the basis for continuous improvement cycle.

10.5.12 Wells, Reservoir, Facility Management

A Wells, Reservoir, Facility Management (WRFM) Plan will be revised annually and integrated with the Field Management Plan, addressing matters such as reservoir management strategy, data acquisition and surveillance plan, and well test requirements. The WRFM Plan will also be an important input into monitoring, surveillance and planning for formation water breakthrough, associated well strategies and GHGEM continuous improvement detailed in Section 10.7.

10.5.13 Manage Decommissioning and Restoration

Decommissioning involves the timely, safe, and environmentally responsible removal of, or otherwise satisfactorily dealing with, Prelude infrastructure. This process is aligned to the key principles for

decommissioning, as outlined in the Offshore Petroleum Decommissioning Guideline (DISER 2022) and the Decommissioning Compliance Strategy 2024–2029 (NOPSEMA 2023), which include:

- Decommissioning is the responsibility of titleholders.
- Early planning for decommissioning to occur as part of the design and concept selection.
- Removal of all property is the 'base case' and is consistent with Australia's international obligations, primarily under the United Nations Convention on the Law of the Sea and the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972, (the London Protocol). Other decommissioning options may be considered but must comply with the OPGGS Act and its regulations, including the principles of ESD.
- Decommissioning must be completed before the end of title to ensure that all decommissioning activities are conducted under the OPGGS Act and regulations framework.

Prelude decommissioning planning commenced in the project development phase and has continued throughout the life of operations, including IMR activities, consideration of late-life asset management, cessation of production, removal of property, plug and abandonment of wells, and finally, title relinquishment.

A Prelude asset decommissioning and restoration plan and cost estimate, incorporating a Subsurface Isolation Strategy to complete safe and efficient decommissioning of wells and all underwater facilities has been prepared to enable sufficient planning for future requirements with SEAM Standards and local regulations. This plan will be updated 3-yearly to comply with the SEAM Manage Abandonment Standard and Manual.

Table 10-6 provides the detailed inventory list covered in the decommissioning and restoration plan including infrastructure specifications (quantity, weight, and dimensions), and decommissioning considerations. The manage asset care works process (see Section 10.5.8) outlines how the asset register will support future IMR activities and satisfy the decommissioning and removal obligations. Routine inspection of all subsea structures is conducted in accordance with established risk based inspection requirements.

Temporary structures, equipment and infrastructure that are no longer in use will be removed (see Section 9.6.4). This approach enables compliance with Section 270, Section 572(2) and Section 572(3) of the OPGGS Act, which require titleholders to remove property when it is neither used, nor to be used, in connection with the operations or other arrangements that are satisfactory to NOPSEMA in relation to the property.

As described in Section 7.2.1 environmental baseline studies have been completed to establish pre-impact environmental conditions throughout the Prelude Activity Area. These environmental baseline studies will enable the eventual title relinquishment process as per Section 270 of the OPGGS Act.

Sub Section 572(2) of the OPGGS Act provides that while property remains in the title area and is used in connection with the operations authorised by this EP, it must be maintained in good condition and repair. The Prelude philosophy for IMR is to inspect and maintain the installed property portfolio such that its mechanical condition remains fit for the purposes specified in its original design requirements. These include but are not limited to integrity, availability, service life, and abandonment requirements. Section 6.10.4 describes the IMR activities.

The future Prelude decommissioning EP (to be developed) will meet the requirements of the OPGGS Act and OPGGS(E) Regulations, and any additional relevant legislation, policies (such as NOPSEMA's Policy: Section 572 Maintenance and removal of property [NOPSEMA 2020]) and guidelines (such as the Offshore Petroleum Decommissioning Guideline [DISER 2022]) in force at the time. Decommissioning options will be assessed before the end of project life as per relevant legislative requirements. These decommissioning options will be evaluated to demonstrate that environmental impacts and risks are acceptable and ALARP during the Prelude Decommissioning EP process.

It is widely acknowledged that various factors that may affect titleholders' consideration of the most suitable decommissioning option, including site-specific environmental and safety risks, type of infrastructure, costs, and available technology/technical feasibility. An ALARP and acceptability assessment of the decommissioning options proposed for the project will provide transparency in decision making where environmental benefits and impacts are clearly presented in the context of a broader framework of decision criteria. The decommissioning and removal of any property from within the title area at the end-of-life will be

undertaken pursuant to a future NOPSEMA–accepted Prelude decommissioning EP, subject to ensuring that such activities do not cause unacceptable environmental impacts.

After the successful completion of decommissioning activities, Shell will apply to surrender the Prelude production and infrastructure licences. Once satisfied that Shell has complied with all requirements for the surrender of these licences, the Designated Authority can consent to the surrender of the licences. It is anticipated that decommissioning and surrender of the licences, from approval of the Decommissioning EP through to the Designated Authority's consent to the surrender of the licences, will take about 12 months.

While the majority of decommissioning will be undertaken at the end of the project's operating life, Shell will look for opportunities throughout the Activity to periodically remove any disused infrastructure, where feasible. Before the end of the Prelude Project's lifespan, various decommissioning options will be assessed in consultation with relevant parties and evaluated for their environmental impacts and risks. Unless otherwise agreed upon through an accepted EP, the Prelude infrastructure will be removed in a manner that ensures environmental impacts and risks are minimised and are ALARP.

Table 10-6: Subsea Decommissioning Inventory List

Item	Specifications				Decommissioning Strategy
	Quantity	*Dimensions (L x B x H – m)*	*Footprint (m^2)*	*Weight (tonnes)*	
Mooring Piles	16	5.5m dia. x 62.5m	24	144	Cut & abandon in-situ
Mooring Chains + wet storage	16	-	-	780	Remove
Mooring Chain Hook Up	16	-	-	-	N/A
Production Manifold Mudmat East	1	19.4 x 19.4 x 3.2		172	Leave in Situ
Production Manifold Mudmat West	1	19.4 x 19.4 x 3.2		172	Leave in Situ
Production Manifold East	1	16.5 x 11.5 x 5.5	190	250	Remove
Production Manifold West	1	16.5 x 11.5 x 5.5	190	250	Remove
Riser Base Manifold Mudmat Foundation	1	23.4 x 23.4 x 2.7	548	240	Leave in Situ
Riser Base Manifold	1	10.7 x 8.1 x 3.7	87	157	Remove
Umbilical Termination Assembly 1 - HDM-1 (UTA1)	1	9.1 x 4.3 x 3.0	40	25	Remove
Umbilical Termination Assembly 2 - HDM-2 (UTA2)	1	5.3 x 3.9 x 3.0	21	14	Remove
Umbilical Termination Assembly 3 - EDM (UTA3)	1	4.6 x 4.2 x 4.5	20	12	Remove
Riser Heel Anchors	4	8.9 x 8.9 x 1.9	80	35	Remove
Pipe Line End Terminations (PLET's)	8	11.1 x 9.0 x 4.3	100	65	Remove
Flowline Suction Anchor Pile	4	11.4m dia. x 13.5	103	252	Remove
Chain Tensioners	4	10.5 x 7.5 x 0.7	75	13.6	Remove

Item	Specifications				Decommissioning Strategy
	Quantity	*Dimensions (L x B x H – m)*	*Footprint (m^2)*	*Weight (tonnes)*	
Hold Back Chains	4	-	-	2 @ 3.5 2 @ 10.2	Remove
Steel flying leads	12	127mm OD	-	9.8 kg/m	Remove
Electrical flying leads	26	29.9mm OD	-	0.9 kg/m	Remove
Flowline Jumpers	10	323.9mm OD + 76.9mm, 84.1mm thick polypropylene insulation		RJ1 - RJ4 ≈ 75 Te PJ1, PJ4 ≈ 63Te MJ1, MJ2, PJ2, PJ3 ≈ 56Te	Remove
Wellhead Jumpers	7	245.9mm OD + 40mm thick Novolastic insulation		P1, P3 - P8 ≈ 19 Te	Remove
Production Flowline	4	12" OD	-		Remove
Flexible Risers	4	12" dia.			Remove
Dynamic Umbilical	1	8.8" OD		353	Remove
ESFL Control Static Umbilical	1	94mm OD		72.6	Remove
Xmas Trees	7	6 x 6 x 6	36	90	Remove

10.5.14 Manage Threats and Opportunities

The purpose of the Manage Threats and Opportunities (MTO) process is to set a structured framework by which an Asset can identify, prioritise, and take action to mitigate threats and realise opportunities to meet Strategic Asset Management Plan and business plan delivery. Figure 10-12 shows an overview of the MTO process. The MTO process is a key tool used in supporting environment management on operating assets. For example, MTO is key in supporting prioritisation of most GHGEM abatement projects (Section 10.7) and supporting the stable management of ECEs (Section 10.5.2).

Figure 10-12: Manage Threats and Opportunity (MTO) Process

10.6 Workplace Health, Safety and Security

10.6.1 Safety Leadership

SEAM standards cover Safety Leadership within Shell which is considered essential for good safety performance and environmental outcomes. This is best illustrated in the AIPSM model (see Section 10.5.1 and Figure 10-7 for more detail) that shows leadership underpins process safety management. Shell believes that visible leadership at all levels creates the safety culture needed to achieve Goal Zero. Goal Zero is the Shell vision for causing 'no harm and no leaks'. This vision underpins Shell's approach to HSSE management across all projects and the organisation and is the basis for HSSE planning and goal setting globally.

Leaders are expected to set the tone and make a difference through their actions, by setting clear expectations and through visible personal commitment and collective care. Within Shell, it is believed that a strong safety culture implemented by Leadership will result in a positive, robust safety and environment outcome.

Shell implements the IOGP Life Saving Rules that are fundamental to Shell's journey to Goal Zero. Compliance with the Life Saving Rules is mandatory. All Shell employees and contractors are introduced to the Life Saving Rules during their induction and make a commitment to comply with these rules. In case of a Life Saving Rule violation, an investigation is conducted in line with the established process. If a violation is confirmed, disciplinary action is applied through the consequence management process. Performance against the rules and the effectiveness of the rules in achieving Goal Zero is monitored centrally. Based on the reviews there

may be modifications to the detail of the Life Saving Rules. These modifications will be adopted and rolled out by Shell under the MOC process.

Safety Leadership Training forms a critical part of Shell's strategy and is embedded at multiple levels of the Shell Front Line Barrier Management (FLBM) competency framework. The level of competency and the degree of demonstration required is role dependent, with supervisors receiving more specific training. Similarly, appointment as a HSSE Critical Leader require the leader to demonstrate the understanding and effective application of Safety Leadership behaviours. Leadership, with a strong focus on safety is critical to guiding teams and projects to achieving outcomes that benefit the business, people, and the environment.

10.6.2 Control of Work

The SEAM Control of Work requirements apply to everyone performing work for Shell including contractors. This includes teams engaged in either Permitted or Non-Permitted Work (e.g., Standard Operating Procedures) that could involve, but not limited to:

- Isolation.
- Confined Space.
- Hot Work.
- Energy Systems (e.g., electrical, Ionizing Radiation, process, etc).
- Penetrations.
- Working at Heights.
- Lifting and Hoisting.
- Other Potentially Hazardous activities (e.g., Diving & Tunnelling, Hydro jetting etc.)

10.6.2.1 Lifting and Hoisting

Lifting is a tightly controlled activity on Prelude. All lifting and hoisting activities must comply with the requirements of the Lifting and Hoisting Standard. The standard outlines the minimum practices in relation to the safe use of lifting and hoisting equipment and lifting operations on the Prelude FLNG facility. The requirements in the Prelude standard are consistent with the SEAM Workplace Health, Safety, and Security Standard.

All lifting equipment is maintained, tested, and inspected in line with the relevant Prelude Maintenance Strategy and certified as safe to use. Non-compliant equipment is tagged out of service and is not to be used.

All lifts are approved in line with the requirements of the Prelude Lifting and Hoisting Standard which aims to reduce risk to persons, equipment, and environment to ALARP. Lifting operations are categorised into one of three types of lifts:

- Routine Lifts;
- Non-routine Lifts;
- Non-routine Complex Lifts.

The degree of detail and level of review and approval for the lift increases with the risk of the lift. Routine lifts are covered via approved procedures and do not require additional approval. Non-routine lifts are not covered by existing procedures and require specific plans to be developed and approved. The conduct of non-routine lifts is managed through the PTW system (see Section 10.4.3).

All personnel involved in any lifting operation are required to attend a Toolbox Talk so that all personnel understand the plan and to ensure reduced risks around persons and environment (dropped objects, etc).

Prelude has been designed to avoid the need for routine lifting over live hydrocarbon equipment. However, if a situation arises where there are no suitable alternatives, the risk management process outlined in the Prelude Lifting and Hoisting Standard will be followed. This ensures that the following considerations are considered:

- The lift is considered as a non-routine complex lift and thus requires a specific lift plan to be developed and approved;

- The alternatives to lifting over live equipment must be considered and documented;
- The lift will be planned in consultation with the designated onsite lifting focal point which will document the lift plan as well as alternatives considered to lifting over live hydrocarbon equipment;
- The risk assessment (incorporated in the lift plan) shall identify appropriate mitigations and controls to reduce the risk associated with the lift (including object dropped to environment protection measures);
- The review and approval levels for the lift plan are determined by the level of risk associated with the lift; and
- Conduct of the lifting activity is managed through the PTW system.

A similar process is used if sensitive (non-hydrocarbon) equipment is identified as part of planning a lift to demonstrate that the risk of impact has been minimised.

10.7 GHG and Energy Management System

Shell Group's GHG targets and ambitions are set out in Energy Transition Strategy (ETS) 2024 (ETS24). The Shell SEAM standard requirements for Greenhouse Gas and Energy Management (GHGEM) define the minimum expectations for each business. The adopted GHG and Energy Management System (GHGEMS) is compatible and complementary with ISO-50001 international standard for Energy Management Systems, and the SEAM Standard Practice GHGEM.

Figure 10-13 summarises Shell Group guidance on how SEAM standard requirements, targets and ambitions are operationalised at an asset level.

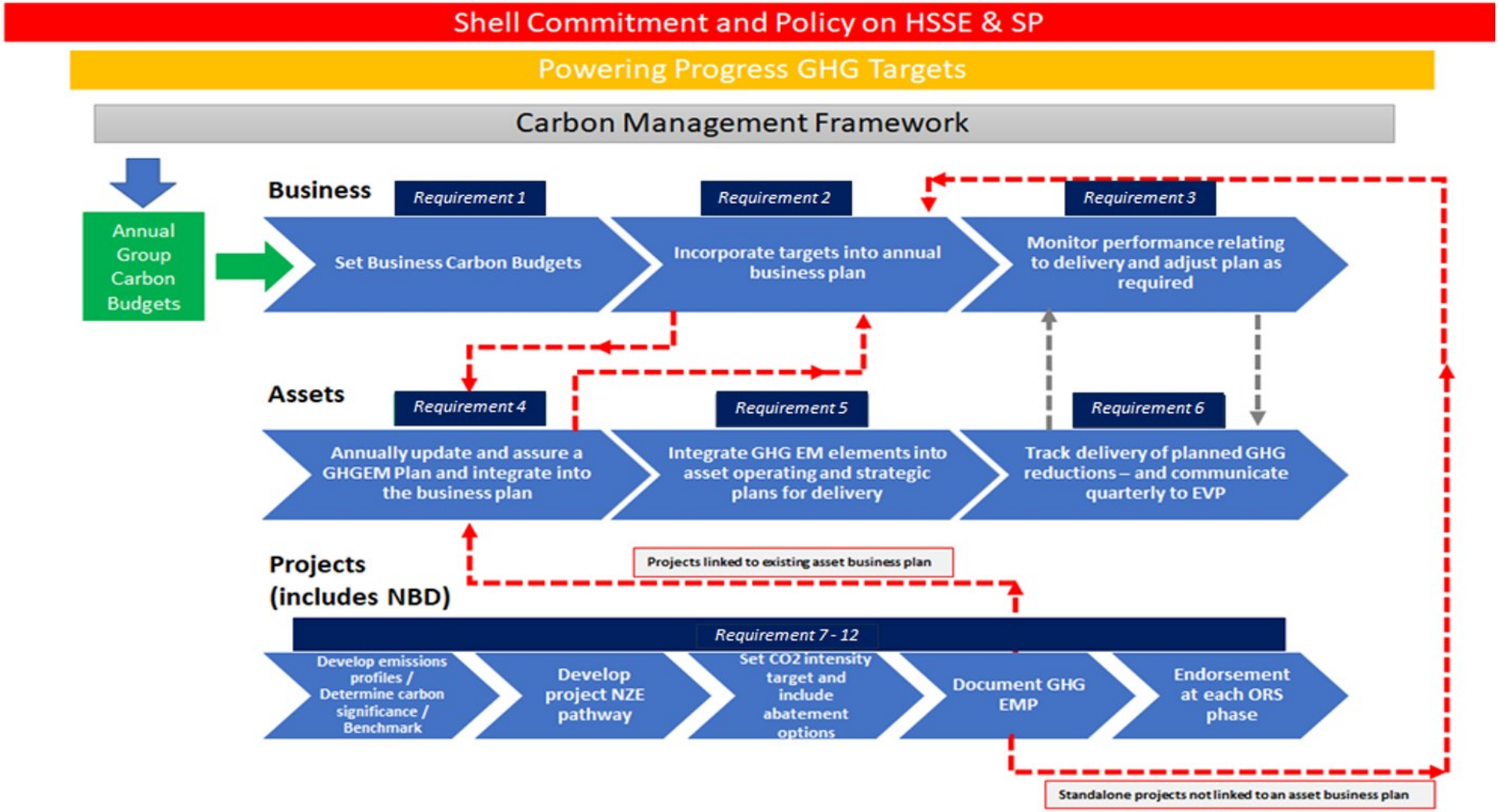


Figure 10-13: The End-to-End GHGEM Process and Interactions Between Group, Business, Asset and Projects

The purpose of the GHGEMS requirements for Shell Businesses (Requirements 1-3), such as Integrated Gas and Upstream, is to demonstrate that Shell has governance in place which ensures external decarbonisation commitments are translated into tangible targets, plans and actions at Assets and Projects.

10.7.1 Third Party End Use and the Role of Gas in the Energy Transition

Shell Group reports on its business activities (including updates concerning gas-related projects) and progress against its business targets, including climate-related targets, on an annual basis in its Annual Report. It also publishes an annual LNG Outlook. Shell Group publishes its Energy Transition Strategy (ETS) every three years—most recently ETS24, with updates currently expected in 2027 and 2030.

Scope 3 emissions, including those associated with the activity, which are equivalent to less than 0.03% of global GHG emission inventories, are outside the operational control of the Prelude joint venture partners (see Section 9.12.5) and of the Shell Group. Shell addresses Scope 3 emissions at a Shell Group level, in view of the global nature of greenhouse gas emissions, and for other structural reasons – i.e. the absence of control over those emissions, which are driven by energy demand, and the existence of portfolio-wide levers to reduce the intensity of emissions at a Shell Group level. Shell is helping its customers to decarbonise and reduce their emissions (Scope 3 emissions), achieved through the application of Shell's Group-wide strategy to deliver more value with less emissions, including targets and processes designed to identify and implement reasonably practicable measures related to the overall emissions profile across its entire portfolio. In the context of Scope 3 emissions, this relevantly includes the Shell Group target to reduce the net carbon intensity (NCI) of the energy products it sells (globally, as compared to 2016) by 15-20% by 2030 and 100% by 2050 (refer to EPS 10.15). NCI measures the emissions associated with each unit of energy Shell sells.

Shell's Group-level targets are subject to ongoing review and adjustment to ensure alignment with evolving regulatory and market contexts, including updates driven by regular reviews of the Shell Group's ETS, LNG Outlook and other relevant policy or industry developments.

Shell monitors and assesses its progress against Group-level targets on a continuous basis. Shell Group disclosures and publications including the Annual Report and ETS review, update and report on these targets, and investments, at least triennially. Any significant change at the Shell Group level to these targets and investments would necessarily be reflected in the Annual Report and, when next updated, the ETS, with any additional measures (or changes to existing measures) determined and implemented through changes to the Group's portfolio management and capital allocation. Records demonstrating that such measures have been considered and, where required, actioned through those processes will be available in the Shell disclosures and publications above.

Following the Shell Group review of the ETS, at the asset level, Shell Australia will incorporate the outcomes of the review, where appropriate and practical, into the subsequent annual update and assurance of the GHGEMP and its integration into the Operating Plan (see Section 10.7.4). This integration supports continuous improvement and adaptive management, ensuring that emissions performance under operational control of the Prelude joint venture partners remains consistent with Shell Group's broader decarbonisation objectives and targets, and that any appropriate and practical asset-level measures are identified, actioned and documented.

10.7.2 Operating Plan

The purpose of the Operating Plan (OP), as part of the Forecast and Plan Production SEAM standard requirement, is to operationalise Shell Group's strategy into a credible and affordable plan, enabling the alignment of the organisation on strategic and operational objectives including carbon management and the allocation of resources. The OP process will provide insights that drive decision quality, encourages realism, offers optionality and flexibility and allowing for appropriate capital allocation and continue to ensure that the operational, financial and carbon metrics are fully integrated. Key GHG outputs from the OP process include targets such as GHG intensity, total emissions, and risked abatement. The targets are approved by senior management. Targets also support achieving Shell Group's climate ambitions and reinforce its priorities and desired behaviours at Shell Group level. These may be different from the plan to set direction and apply stretch. GHG emissions forecasts are an integral part of the OP process derived from development concepts, production inputs and assumptions, production forecasts and hydrocarbon maturation, well reservoir and facility management, decommissioning and restoration, cost, commercial, economic, financial inputs and assumptions, along with associated risks and opportunities. Relevant technical authorities and management level signoffs occur from discipline lines through the delivery of the process.

10.7.3 Carbon Management Framework

The Carbon Management Framework sets the nature of decarbonisation efforts across Shell. It does this by prescribing Carbon Budgets for each business aligned to our external decarbonisation commitments to achieve Net Zero Emissions. These forward-looking budgets reduce over time, dictating the level of Scope 1, 2, and 3 emissions each business can emit annually in future years. The focus is on achieving Shell's external Net Zero Emission (NZE) targets while maximising value. Shell Businesses action the Carbon Budgets in Operating Plan through Tone Letters or Guidance, which translate these business-level budgets into level of ambition for Assets and Projects across that business to reduce emissions. Businesses are required to deliver plans within the Carbon Budgets and use Marginal Abatement Cost Curves to ensure maximise value within a carbon constraint. These curves are also used at Group-level to optimise plans across businesses.

As mentioned above, GHGEM Planning is purposefully integrated with Operating Plan to drive desired performance across businesses. The business essentially follows a five-step process to do this:

- Analyses data from the last Operating Plan cycle, information from abatement planning and emissions reporting tools to set targets for Scope 1 & 2 emissions. Flaring and methane information is also considered to ensure reduction trajectory aligned to related external commitments.
- Communicates its targets to its projects, Assets and ventures via the business Carbon Budgets and operating plan tone letter or similar.
- Compiles, validates, and endorses preliminary Operating Plan GHG data submitted from the Assets and projects.
- Where necessary, applies Management Adjustments to the endorsed GHG data. These adjustments may reflect leadership confidence in production forecasts, views on in-plan/out-of-plan status of projects, and adjustments necessary to optimise carbon/value optimisation across their portfolio. The assets and projects incorporate the Management Adjustments into their Operating Plan.
- Monitors GHG emissions and the delivery of planned emissions reductions, surfacing risks and opportunities and act to maintain a trajectory consistent with targets where reasonably practicable.

The purpose of the GHGEM Requirements for Shell Assets, such as Prelude, is that we have a clear and credible plan each year for the delivery of the Asset part of the Business's Carbon Budgets and to ensure the plans provided have all the essential elements to reasonably confirm agreed GHG reductions can be delivered and compared to that of other Assets within the broader Business and Shell Group.

The Requirements align with the continuous improvement model, meaning that each iteration of the annual cycle should enable a decarbonisation trajectory to meet external commitments (Figure 10-14).

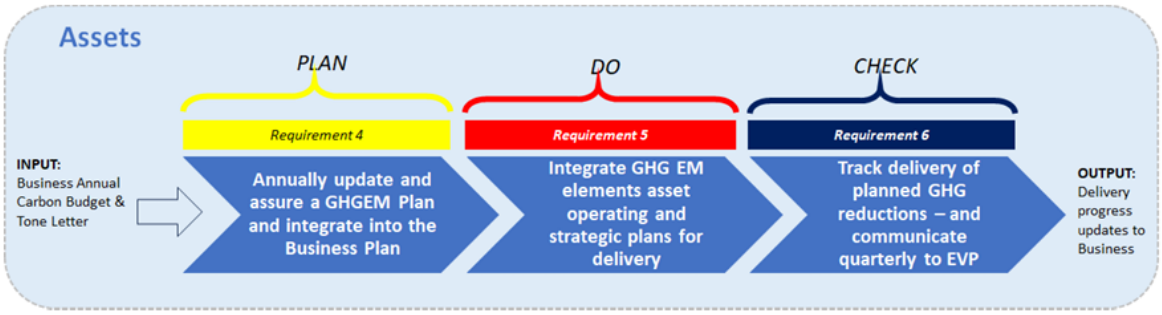


Figure 10-14: Asset GHG Requirements Aligned with the Continuous Improvement Model

10.7.4 Annually Updating and Assuring a GHGEMP integrated into the Operating Plan

Aligning with the 'PLAN' stage of the continuous improvement model for Assets, the annual update and assurance of the GHGEMP and its integration into the Operating Plan, can be fulfilled in six main steps (Figure 10-15) .

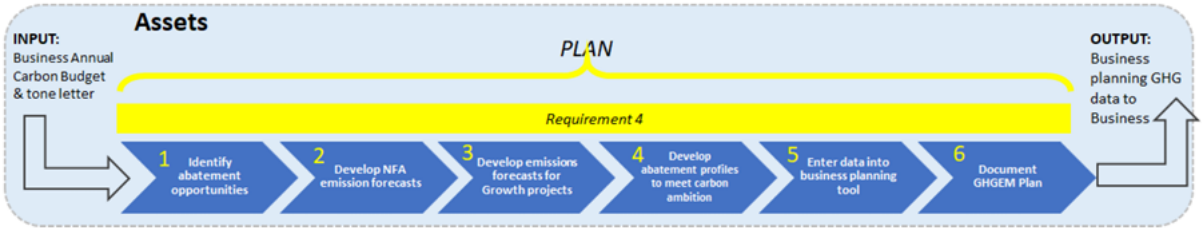


Figure 10-15: Guidance Steps to Fulfil Requirement 4

The plan is to fill the abatement opportunity funnel with a broad selection of abatement opportunities in advance of the Operating Plan cycle. This is done at any point in the year and repeated each year (refer Section 10.5.12). The points below give guidance on how to identify and rank abatement ideas.

Step 1: Generate ideas for energy savings and GHG reduction through Best Available Technology reviews, interviews and/or multidisciplinary workshops.

This process involves an annual GHG abatement workshop which is held to help identify risks and opportunities to minimise or reduce GHG emissions through abatement or efficiency gains. The GHG abatement opportunities may be either operational improvements or capital projects. Every three years, in line with the Shell Global triennial review, an assessment of previously eliminated abatement opportunities, including equipment-based controls, will be reassessed together with consideration of advances in emission reduction technologies which may be applicable. The workshop participants will be comprised of a multidisciplinary team, which typically includes operators and engineers from various disciplines and functional groups. Outputs include a list and description of identified abatement opportunities, high level technical feasibility screening of the opportunities, the estimated cost of such opportunities and abatement volume estimates. Ideas of GHG abatement opportunities can also be raised by the workforce at any time through the Manage Threats and Opportunities (MTO) process (see Section 10.5.14).

An assessment process will ensure technically feasible abatement opportunities are then further screened and assessed through MTO. Where assessment has been completed, relevant capital projects are assessed in accordance with relevant internal processes. Those capital projects that are subsequently screened to be in-plan are then put into the proceeding OP cycle so that budgets and resources can be assigned according to the priority given so projects can continue to be pursued using the relevant internal processes. Out of plan projects are generally reviewed on an annual basis unless they are deemed not technical feasible or practical or are clearly well beyond being economically viable to consider being in plan for the foreseeable future.

Step 2: Develop 'No Further Activity' (NFA) Emission Forecasts & CO_2 Costs for Existing Assets. NFA emissions for Assets are based on historical emissions data, and adjusted (as required) for implemented projects, future production profiles and planned production outages.

Step 3: Develop Emission Forecasts/ Costs for Growth/Hydrocarbon Projects. This step is for growth projects, either integrated into an existing Production Unit (e.g. tiebacks/backfills), or new, standalone but within an Asset.

Step 4: Forecast Abatement Profiles/Costs to Meet Carbon Ambition. The Asset sets its carbon ambition by comparing the production emissions forecast with the abatement emissions forecast, and then deciding which abatement projects to include in plan. This choice will depend upon the ranking criteria.

Step 5: Enter Data into Business Planning Tool Once the data is entered into the Operating Planning Tool, the data is available for the Business to review and endorse.

Step 6: Document GHGEMP

The GHGEMP is the key document used by Prelude and Crux to describe how the asset will continually manage GHGEM to ALARP and acceptable levels throughout the operation of the facility. The GHGEMP details:

- GHG emissions and energy use measurement, calculation and assumptions
- GHG and energy benchmarking
- GHG abatement opportunities and projects
- Methane Management
- GHG and production forecasts
- GHGEM targets

10.7.5 Integrating GHGEM Elements of the Operating Plan into Asset Plans for Delivery

Aligning with the 'DO' stage of the continuous improvement model for Assets, integration of GHGEM elements of the Operating Plan into Asset plans for delivery, can be fulfilled in four main steps (Figure 10-16).

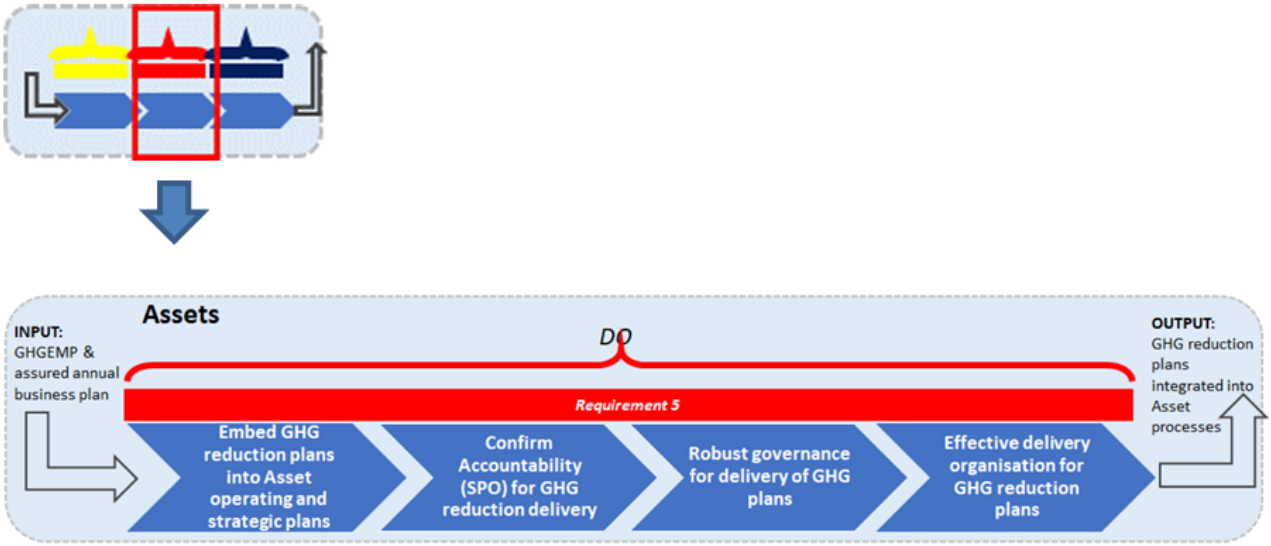


Figure 10-16: Guidance Steps to Fulfil Requirement 5

Step 1: Embed GHGEMP into the Execute Strategic Asset Management Plan (eSAMP) and/or Asset Improvement Plan (AIP)

The SAMP is developed ahead of the Operating Planning cycle and then updated after submission of the Operating Plan to include any changes arising from the Operating Plan endorsement. For the SAMP development, consideration is given to how GHG emission reductions and energy management can be value levers and sources of competitive advantage for the Asset/production units.

Incorporate GHGEM reduction targets and plans from the Operating Plan into the SAMP so that top-down commitments on carbon are reflected in the bottom-up aspirations and realities of the Asset/production units. Update the SAMP and/or Asset Improvement Plan (AIP) to include tactics on delivery of GHG & EM initiatives/projects to close the Gap to Potential for the GHG & EM value levers.

Step 2: Confirm Accountability for GHG Reduction Delivery for the Asset

Fulfilling the Shell GHGEM Requirements is mandatory for Shell operated assets and the Asset will have a Site Process Owner (SPO) for the GHGEM process as specified in Requirement 5. The SPO is accountable for ensuring the Asset develops and delivers decarbonisation plans to meet external commitments on carbon, flaring and methane, as determined by the Business. Accountability extends to each of the following points:

- GHG emissions identification, quantification, and reporting
- GHG emissions forecasting for NFA and growth
- GHG emissions reductions identification and development
- Development and documentation of the GHGEMP and translation into the annual Operating Plan (with assurance accountabilities/responsibilities)
- Establishment of governance and delivery processes to underpin delivery of the GHGEMP and endorsed SAMP and/or AIP and Operating Plan
- Clear and transparent decisions on decarbonisation choices, regrets, and priority versus other business drivers
- Monitoring and reporting of GHGEMP and endorsed Operating Plan delivery progress and communication of delays to Asset Vice President
- The SPO will appoint Site Process Focal Point(s) (SPFP), responsible for GHG emissions and reductions identification, quantification, and forecasting.

Step 3: Establish Effective Governance for Delivery of GHG Reduction Plans

Table 10-7 details the key roles and responsibilities for governance of the GHGEM at Prelude at the time of writing this EP.

Table 10-7: GHGEMP Governance, Accountability and Assurance

Role	Responsibility
Vice President Prelude-Crux	• GHG (total emissions, intensity, and abatement) targets will be set and tracked on a monthly basis (quarterly for abatement) to ensure GHG emissions are ALARP on an ongoing basis. • Ensuring resources needed for the GHGEM are available. • Ensuring GHGEM achieves its intended outcome(s). • Directing and supporting persons to contribute to the effectiveness of the GHGEM processes. • Supporting other relevant management roles to demonstrate their leadership as it applies to their areas of responsibility.
GHGEM Site Process Owner (SPO)	• Preparing and implementing GHGEMP on behalf of Vice President Prelude-Crux. • Ensuring the GHGEM scope and boundaries are established in GHGEMS. • A surveillance program is in place for the power generation units to ensure that they are operating within the design operating envelope. • Ensuring the integration of the GHGEM requirements into asset processes. • Ensuring action plans are approved and implemented. • Communicating the importance of effective energy management and of conforming to the GHGEM requirements. • Promoting continual improvement of energy performance and the GHGEM. • Ensuring the formation of an GHGEM management team (fuel and flare forum). • Ensuring that processes are established and implemented to identify and address changes affecting the GHGEM.
GHGEM Site Process Focal Point (SPFP)	• Assurance on GHG sources, production, emission actuals, emission forecast and abatement data.

Role	Responsibility
Reservoir Engineering TA2	• Assurance on reservoir related forecasts.
Environment TA2	• Assurance on GHGEMP.

Step 4: Resource an Effective Delivery Organisation for GHG Reduction Projects. The delivery organisation for GHG reductions may either be the Asset team (for smaller initiatives) or a project team (for initiatives that require design development and more involved execution). Once the GHG reduction projects are integrated into the Asset plans, their delivery should be underpinned by availability of named and competent resources with clear accountability, as well as progress visualisation on resources required and how the GHG reduction project/ initiative will be delivered.

10.7.6 Tracking Delivery of Planned GHG Reductions

Aligning with the 'CHECK' stage of the continuous improvement model for Assets, tracking delivery of planned GHG reductions can be fulfilled in three main steps (Figure 10-17).

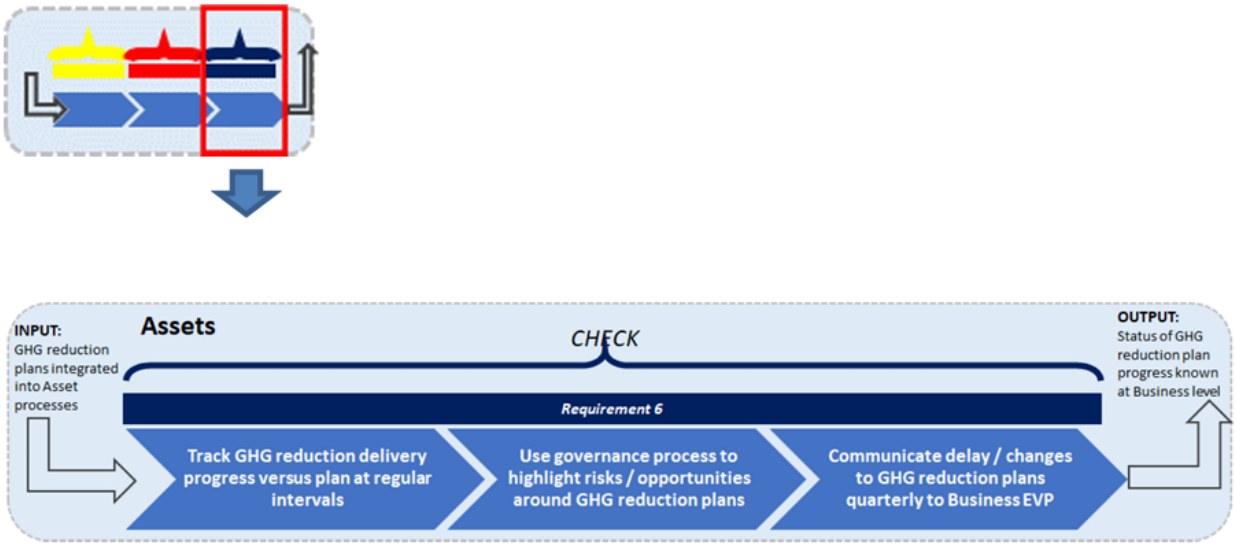


Figure 10-17: Guidance Steps to Fulfil Requirement 6

Step 1: Track GHG Reduction Delivery Progress vs. Plan at Regular Intervals.

Step 2: Use Governance Process to Highlight Emerging Risks/Opportunities around GHG Reduction Plans.

Step 3: Communicate Delay/Changes to GHG Reduction Plans Quarterly to Senior Executive with Single Point Accountability of the Business.

Steps 1-3 above are implemented for Prelude and Crux (once operational) through the monthly Fuel and Flare Forum. This is a multi-disciplinary team that brings together expertise from relevant functions in the asset to consistently manage the risks and work on the ongoing GHGEM dilemmas as they arise. This will:

- Enable better cross facility understanding and discussion of the fuel and flare balance.
- Drive continuous improvement to reduce GHG emissions.
- Prioritise improvement opportunities.
- Keep log of opportunities (potential and delivered).
- Collaboratively discuss dilemmas.

The inclusion of the Crux asset into the Fuel and Flare Forum will commence no later than 6 months post completion of second stage well clean-up.

Supporting this also, Prelude and Crux will use a selection of the measures of process effectiveness, tailored for Prelude and Crux, outlined in Table 10-8 below from Shell Group guidance to determine the GHGEMS process effectiveness.

Table 10-8: Guidance on Measures of GHGEM Process Effectiveness

PI Category	PI Description	Leading/Lagging	Reference to Standard	Industry Best in Class	Reason for Metric
Asset GHG Targets	Set Scope 1 & 2 emissions targets for Asset ahead of Operating Planning cycle (and agree with Business).	Leading	GHGEM	Annually	The Asset has a clear GHG reduction plan which aligns with the Business's broader GHG reduction target.
Top 10 Good and Bad Actors	Periodic reporting of the top 10 energy good and bad actors	Lagging	Perform Hydrocarbon and Energy Accounting Standard		Impacts GHG intensity performance, absolute emissions and utility cost
Abatement Options Delivery	Tracking of delivery of abatement options (and GHG volume reductions) in line with plan.	Leading	GHGEM		Impacts delivery of Business Carbon Budgets

10.7.7 Methane and Fugitive Emissions Management

Shell is a signatory to the United Nations Environment Programme's Oil and Gas Methane Partnership 2.0 (OGMP) initiative, the only comprehensive, measurement-based reporting framework for methane emissions in the oil and gas industry. Under OGMP, assets are required to progress a Level 3 reporting standard, which relies on generic emission factors (EFs), to Level 4 (bottom up) source level measurement-based emission factors and Level 5 (top down) site level emission rates, with reconciliation conducted between source level and site level data. The Level 4 surveys are conducted for fugitive emissions by an optical gas imaging camera and quantified using a Hi-Flow sampler, while Level 5 surveys of the site are conducted by use of suitable technology for site level emissions monitoring, such as Remotely Piloted Aircraft Systems (RPAS drones) with sniffer sensor. The use of a hi-flow sampler as part of the OGMP standard provides accurate quantification of leaks which assists in risk mitigation and leak repair, while the Level 5 survey and subsequent reconciliation validates the quantification and enables additional asset monitoring to be completed as required.

Prelude conducts the leak detection and repair (LDAR) survey in accordance with the Shell LDAR Recommended Practice and in line with the Prelude Loss of Primary Containment (LOPC) Management Procedure. All identified fugitive emissions are recorded in the facility leak register and risk assessed for maintenance scheduling. Prioritisation of leak repairs is assessed based on a combination of factors including process safety and health risks, impairment complexity and leak magnitude, which incorporates consideration of the resulting GHG emissions. Feasibility of repair is also an important factor when assessing prioritisation of repair. For example, some leaks may require a partial or full facility shutdown to allow for repair, whilst others may be conducted on the run while the facility is operating. Repairs maybe executed opportunistically during unplanned shutdowns to ensure emissions are driven towards ALARP. Both Level 4 and Level 5 surveys are completed at least once each calendar year as standard IAP operational activities. As part of this OGMP commitment, Prelude will continue to undertake OGMP Level 4 and Level 5 surveys at least once per calendar year to achieve the OGMP Gold Standard of reporting and incorporate the data into Shell's emissions reporting.

10.7.8 Flare Target Setting

Flare targets (baselines) for both “holding” mode – when the facility is producing at steady rates – and “loading” mode – when the facility is producing but also transferring product into an LNG carrier – were established for Prelude at the end of 2022. The baselines provide the asset with a mechanism to monitor performance and ensure that flaring is reduced to ALARP. A holding baseline of 20 tHC/d has been set for planned flaring, which only includes flaring from the condensate tanks and the PW flash gas vessel. Setting of the loading baseline is reassessed annually and is based on previous operational data and learnings, as well as the production forecast, and are aligned with the estimates risk assessed in Section 9.12, hence deemed to be ALARP and acceptable. Progress against the baselines are monitored daily in the DSR meeting and are discussed monthly in the Fuel and Flare forum.

Both planned intermittent flaring and unplanned flaring are managed to ALARP through implementation of the Operations Playbook and the Fuel and Flare Policy. The Fuel and Flare Policy outlines the expectations around fuel and flare management in accordance with the HSSE & SP MS and specifically sets the requirements for minimising flaring during planned intermittent and unplanned flaring events.

10.8 Environmental Performance Monitoring

Monitoring and review form a part of normal operations, the production, safety, and environmental performance of Prelude is analysed on a continuous basis. Structured meetings are incorporated into the standard working day to provide opportunities for teams to discuss the performance and implement plans to address issues as they arise. Critical elements of environmental performance are achieved by the quantitative monitoring of emissions and discharges with various tools and systems to assess whether the EPOs and EPSs in the EP are being met. Parameters that are monitored and recorded during the Activity are detailed in relevant parts of Section 9 and are summarised in Table 10-9. Where online analysers are the primary monitoring equipment/methodology and where not specified, the intent is always that if the online analyser is not available, engineering calculation estimation or manual sampling will be used as a contingency. A key part of environmental monitoring is formed through Key Performance Indicators (KPIs) which have been identified as providing an indicator of both production and process performance.

Table 10-9: Emissions and Discharges Monitoring for Prelude Facility

Source	Parameter to be Monitored	Monitoring Frequency	Monitoring Equipment/ Methodology*	Records
Drainage Discharge	Oil Content Flow	On-line	On-line analysers	PI Database
Treated Produced Water Discharge	Flow Total Petroleum hydrocarbons	On-line	On-line analysers	PI Database
	Mercury	Every 2 weeks for Prelude only production Weekly following the introduction of Crux gas	Onboard laboratory analysis	Laboratory records
	Chemical characterisation and DTA sampling analysis per Section 10.8.1	Per Section 10.8.1	Sampling and third-party laboratory analyses	External laboratory reports
Cooling Water Discharge	Flow Free chlorine Temperature	On-line	Calculation	PI Database

Source	Parameter to be Monitored	Monitoring Frequency	Monitoring Equipment/ Methodology*	Records
Brine Discharge	Flow	On-line	On-line analysers	PI Database
Boiler Blow-down Discharge	Flow pH	On-line	On-line analysers	PI Database
Neutralisation Tank Discharge	Flow pH	On-line	On-line analysers	PI Database
Emissions from boilers	Fuel consumption GHG emissions Particulate matter (PM) Sulphur dioxide (SO_2) Nitrous oxide NOx) Carbon monoxide (CO)	On-line (Flow) On-line Gas Chromatographs Engineering Calculations	Hydrocarbon & Air Emissions Accounting Methodology	PI Database NPI and NGER reports
Diesel fuel used on the FLNG and support vessels	Sulphur content	As required (every delivery)	Delivery certificates Laboratory sampling	Delivery certificates
	Volume used	Monthly	Delivery certificates and storage tank volumes	PI Database Delivery certificates
Flaring emissions	Total gas flared GHG emissions Sulphur dioxide (SO_2) Nitrous oxide NOx) Carbon monoxide (CO)	On-line (flow) Engineering Calculations	Hydrocarbon Accounting Methodology	PI Database NPI and NGER reports
Acid gas vented	Total gas vented GHG emissions	On-line (flow) Engineering Calculations	Hydrocarbon Accounting Methodology	PI Database NPI and NGER reports
Fugitive emissions	GHG emissions	Online (HP separator flow) Engineering Calculations	Hydrocarbon Accounting Methodology	NPI and NGERS reports
Waste generation	Hazardous Waste Non-Hazardous Waste	Monthly	Waste records/manifests	Monthly waste reports
Accidental releases of hydrocarbons or chemicals	Volume of accidental release Characteristic of release	As required	If unmetered, volumes will be estimated based on technical data and evaluations (e.g. known well flow rates, production flowrates, pressure, duration of release and known inventory volumes)	Incident reports in Fountain Incident Management

Source	Parameter to be Monitored	Monitoring Frequency	Monitoring Equipment/ Methodology*	Records
Ad Hoc liquid discharges from FLNG	Water quality Volume of discharge	As required.	Laboratory sampling as required.	MOC records

10.8.1 Produced Water Adaptive Monitoring and Management Framework

The Prelude Produced Water Adaptive Monitoring and Management Framework (AMMF) is a comprehensive plan designed to manage the environmental impacts associated with PW discharges from the Prelude facility. The detailed AMMF is provided in Appendix F.

The AMMF aligns with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018 and 2023) and the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations, ensuring that measures are updated based on new information and changing conditions. The AMMF is also equivalent to the process described within Risk Based Assessment of Offshore Produced Water Discharges (IOGP 2020).

The AMMF outlines a systematic approach to adaptive management, involving the setting of Environmental Performance Outcomes (EPOs), implementation of Environmental Performance Standards (EPS) management measures, and continuous monitoring and feedback. Outcomes and recommendations from the PW monitoring and adaptive management actions conducted in accordance with the previous Prelude FLNG Operations Environment Plan (refer to Section 9.9) have been critical to the development of this AMMF. Key monitoring methods used in the AMMF include Direct Toxicity Assessment (DTA), chemical characterisation, mechanistic toxicity modelling, and sediment monitoring.

The AMMF incorporates Direct Toxicity Assessment (DTA) and chemical characterisation as primary methods for evaluating the potential environmental effects of PW discharges. This approach allows for a detailed understanding of the toxicity of complex mixtures of contaminants, facilitating more effective and responsive management actions.

By adopting this robust adaptive management approach, Shell aims to manage residual uncertainties associated with PW discharges, maintain environmental changes within acceptable limits, and continuously improve environmental performance. The AMMF is an integral part of the broader EP supporting Shell's commitment to sustainable and responsible environmental stewardship. The AMMF also meets the Shell requirements for a Water Stewardship Management Plan under the SEAM Standards which aligns to the International Water Stewardship Standard principles (AWS 2019).

The AMMF, consistent with the approach defined in the Australian and New Zealand Governments (ANZG) Guidelines for Fresh and Marine Water Quality (2018), is a continuous cycle of improvement. It involves setting environmental performance objectives (EPOs), developing and implementing management measures and measuring results. The results from monitoring are then fed back into new EPOs, management measures, and actions, which will be detailed in subsequent EP 5 yearly revisions submitted to NOPSEMA. This approach ensures that management measures are updated appropriately based on new information and changing conditions, allowing for more effective and responsive management of the PW discharge.

10.8.2 Ad Hoc Liquid Discharge Monitoring and Management

Figure 10-18 describes the process that will apply to non-routine ad hoc discharges during the activities that aren't already implicitly described and assessed in the EP. The process ensures the nature, extent and potential effect of these discharges are adequately understood and assessed to determine potential changes to water quality or other environmental values and sensitivities to ensure impacts and risks associated with such discharges are always managed to ALARP and acceptable levels. Figure 10-18 illustrates the ALARP/Acceptability Assessment that will be undertaken alongside the Management of Change Process to enable a decision for the acceptability of discharge (or alternative options).

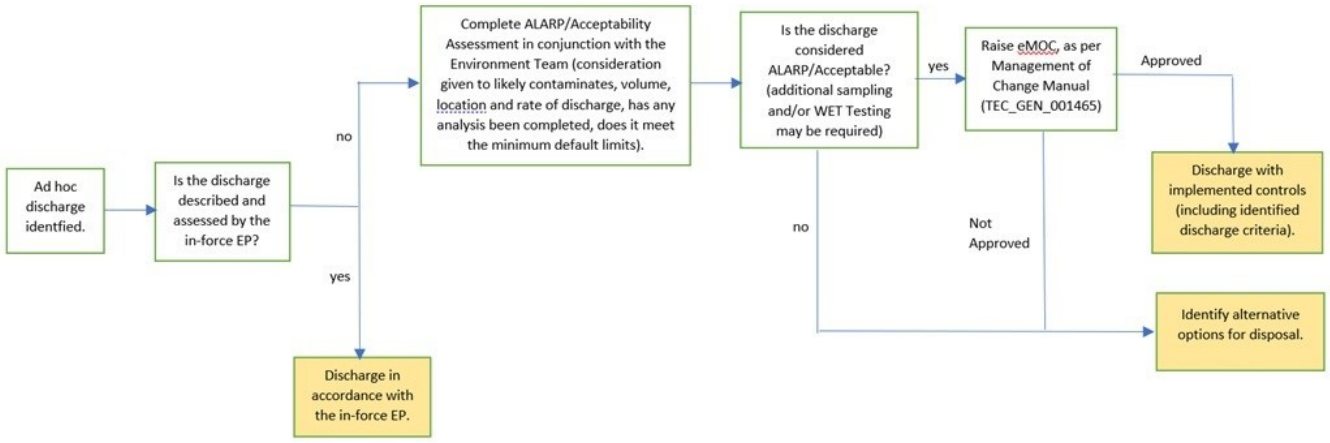


Figure 10-18: Conceptual Ad Hoc Discharges Management Framework

10.9 Management System Assurance

The Management System provides a structured and documented system for managing HSSE Assurance. In this process, both Shell and Contract HSSE Plans make provisions for monitoring, audits, and review as relevant to the scope of work.

The Asset is tasked with:

- Operationalising the Shell HSSE and SP Commitment and Policy (Section 4.2) through their objectives, targets and plans
- Ensuring that controls are communicated to employees and contractors
- Development of annual assurance plans that objectively confirm whether controls are designed and operating effectively, as well as to confirm the overall effectiveness of risk management.

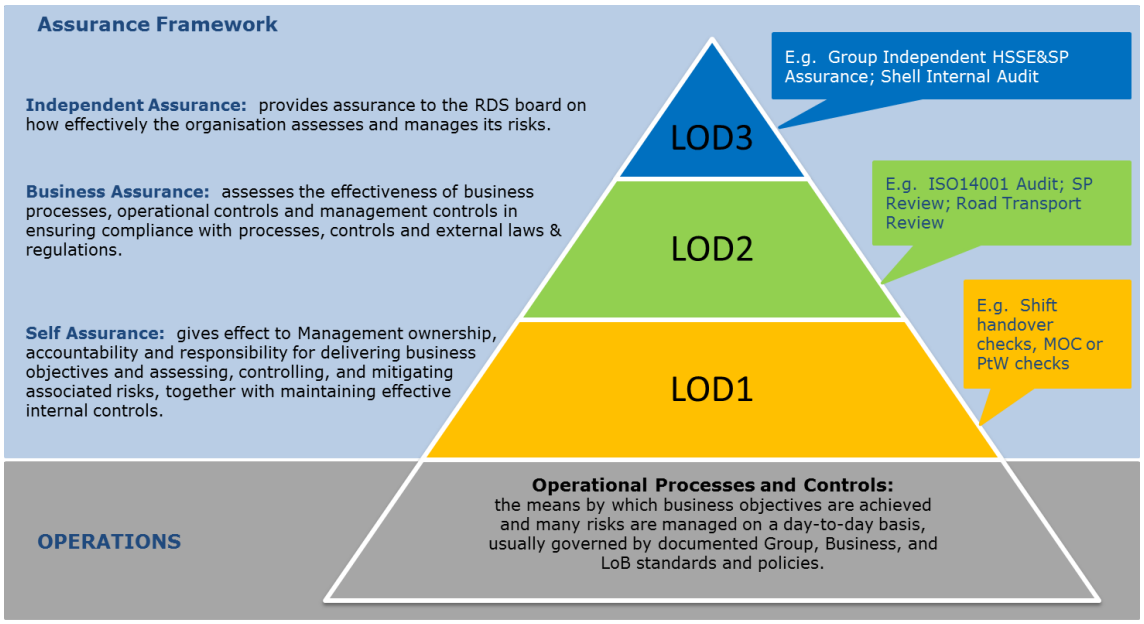


Figure 10-19: Shell Group Tiered Assurance Framework

Compliance with the Line of Defence (LOD) 1 program is monitored by the relevant Process Owner. Results of the program are reviewed regularly by the Process Owner to address any compliance gaps and identify opportunities for continuous improvement.

LOD2 and LOD3 assurance activities are monitored by the business as part of an overall assurance plan. Findings from the assurance activities are analysed and actions implemented to address any identified gaps and opportunities for improvement. The completion of actions is tracked via a centralised action tracking system.

Contractors are also audited as part of the overall assurance program, either through their HSSE Management System for Mode 2 and 3 contracts, or through the Shell assurance processes directly as Mode 1 contracts.

10.9.1 Audits and Assurance

At the Country level (Australian Operations) Shell has a HSSE Audit and Assurance Procedure and HSSE Assurance Plan that establishes the annual assurance program for the Management System, and this is documented in the Management System. Results from all HSSE LOD2 or LOD3 audits are reported to the Shell Australia Business Assurance Committee (BAC) and relevant Country Coordination Team (CCT). Leadership monitors the status of close-out of actions from audits and other assurance activities. The CCT monthly meeting takes the findings of audits into consideration as part of their annual review of effectiveness of the Management System.

At the asset level, the Vice President Prelude-Crux and the S&E Manager (Asset) are responsible for the design and delivery of the audit and assurance programs in accordance with the Shell Australia HSSE Audit and Assurance Procedure, and this includes:

- Defining key risks, barriers and controls within the activity scope.
- Implementation and monitoring of the audit program.
- Defining and monitoring the follow-up of actions from asset audits and self-assessments until they are implemented and closed out.

The annual assurance program will contain an environmental performance assurance schedule specific to this EP to:

- Verify environmental risks and potential impacts are being managed in accordance with the EPOs and EPSs detailed in this EP.
- Monitor, review, and evaluate the effectiveness of the controls, including associated EPOs and EPSs detailed in this EP, in reducing impacts and risks to ALARP and acceptable levels on an ongoing basis.
- Verify effectiveness of the EP Implementation Strategy.

10.9.2 Regular (Daily) inspections

Regular, typically at shift handover, operator assurance is conducted as part of SoSO rounds as described in Section 10.5.6.3. Any specific environmental issues identified during the SoSO are raised in Team meetings and resolved as part of continually reducing the risks to ALARP and Acceptable levels.

10.9.3 Tracking

Audit and assurance findings relevant to continuous improvement of environmental performance are tracked through an Action Tracking Register. This Register is used to track compliance with EP commitments, including any findings and corrective actions. Non-conformances identified will be reported and/or tracked in accordance with Section 10.12.2.

10.9.4 Transport Safety

SEAM Standards have requirements relating to maritime and aviation safety which also have direct implications on environmental management in the field (cargo transport vessels, vessels, field operations, etc). These standards require that the asset obtains endorsement of procedures for managing maritime and aviation safety risks from defined and competent subject matter experts in the organisation. This will ensure that:

- Prelude procedures embed organisational, and industry wide learnings aimed at managing maritime and aviation risks to ALARP.
- Appointed SMEs (who understand maritime and/or aviation risks) have the necessary authority and competence to review, apply and endorse maritime and/or aviation procedures.
- Procedures for maritime and/or aviation risk management are not developed without the endorsement of appropriate expertise.

These Standards are applied to manage marine and aviation safety in accordance with the Shell Group Requirements and where, for aviation, specifically 'Shell Group Requirements Aircraft Operations (SGRAO)'.

Shell Maritime Safety establishes practices and specifications for the vetting and management of marine vessels in the supply chain that provides guidance on ALARP controls and evaluation methods. These standards are applied to marine vessels used in the fulfillment of Activities (such as support/supply vessels, ASV and IMR vessels within the Activity Area).

Numerous assurance steps are required to assure positive vetting. These involve marine and aviation SMEs, Country Security Manager(s), Marine Warranty Surveyor (MWS), and the project workstreams responsible for the activity. Equivalent processes also apply for aviation services.

10.9.4.1 Marine Assurance

Shell Maritime SEAM standards establish practices and specifications for the vetting and management of marine vessels in the supply chain that provides guidance on ALARP controls and evaluation methods. These standards are applied to marine vessels used in the fulfillment of Activities (such as support/supply vessels, ASV and IMR vessels within the Activity Area).

The Marine Vessel Assurance process ensures that the vessel's physical controls are robust, including:

- Navigation equipment and aids.
- Communications equipment.
- Dynamic Positioning (DP) systems.
- Lifting equipment.
- Emergency shut-down, alarm and lighting systems.

Oil Companies International Marine Forum (OCIMF) Offshore Vessel Inspection Database (OVID) is the basis for all vessel vetting. Additionally, vessels are screened for class and port state control infractions. The following assurance and compliance activities are undertaken for the positive vetting of vessels, where applicable to the class or risk profile.

10.9.4.1.1 Marine Warranty Survey

All vessels and activities will be assessed by the MWS on behalf of Shell's underwriter. Where required by the MWS, a marine vessel inspection/suitability survey is carried out in accordance with Construction All Risk insurance rules. The MWS issues a vessel suitability report with all significant actions and findings closed.

10.9.4.1.2 Pre-Mobilisation Inspection Report

The pre-mobilisation inspection is done to ensure compliance with HSSE, marine and technical requirements and readiness before the vessel commences work. The vessel (inclusive of equipment, processes, and procedures) is thoroughly inspected; inspection report items must be closed before mobilisation.

10.9.4.1.3 Shell Aircraft International Approval

Shell Aircraft International (SAI) approval is required for all helidecks used for personnel transport. Helicopters and their refuelling equipment must also be approved by SAI.

10.9.4.1.4 Group Maritime Assurance System Clearance

Group Maritime Assurance System (GMAS) clearance from the Shell Marine SME must be obtained before commencing marine operations at the Prelude FLNG and before any contracted marine vessel can enter the Activity Area. GMAS clearance ensures that marine vessel assurance has been completed satisfactorily.

10.9.4.1.5 Biofouling Risk Assessment for Vessel Movements

Shell will manage vessel compliance with biosecurity requirements as part of the Shell marine vessel assurance process and the vetting procedure. A biofouling risk assessment will be conducted for all vessels before mobilising to the Activity Area. The IMS risk assessment process is commensurate to the risk and will depend on the location of the port of origin for each vessel as follows:

- vessels entering Australian territorial seas [12 nm limit] from international locations
- vessels entering the Activity Area directly from international locations
- vessels (as appropriate for size, type and class) entering the Activity Area from Australian domestic locations.

Biofouling management for vessels entering Australian territorial seas [12 nm limit] from international locations, prior to entering the Activity Area, will apply the Australian Biofouling Management Requirements (DAFF 2023) which implements the requirements of the *Biosecurity Act 2015* (Cth) and the IMO 2011 Guidelines for the Control and Management of Ships' biofouling to Minimize the Transfer of Invasive Aquatic Species. All vessel operators that intend to enter Australian territorial waters (outside of the Activity Area) must provide biofouling management information (refer to EPS 6.2) through the mandatory pre-arrival report 12–96 hours prior to arrival via the DAFF reporting systems (Maritime and Aircraft Reporting System [MARS] and Vessel Compliance Scheme[92]). The MARS Biosecurity Document is required to demonstrate a low–risk status prior to entering the Activity Area.

Biofouling management for vessels entering the Activity Area directly from international locations or locally sourced vessels from Australian domestic locations (as appropriate for size, type and class) will implement the following requirements derived from the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2009):

- Conduct a biofouling risk assessment using an industry recognised IMS inspector or using the industry recognised risk assessment tool
- Undertake IMS risk reduction measures as guided by an industry recognised IMS inspector if a vessel is not considered low–risk
- Only vessels classified as low risk will be permitted entry into the Activity Area.

10.9.4.1.6 Vessel Risk Status

Vessels must achieve a low–risk status to demonstrate to Shell that the IMS risk has been reduced to ALARP. The risk assessment categorises the vessel's risk status as:

- low–risk: low–risk of introducing IMS of concern; no additional management is required
- uncertain–risk: the risk of introducing IMS is not apparent; a precautionary approach is adopted, and additional management options is required to achieve a low–risk status
- high–risk: high–risk of introducing IMS; risk reduction measures are required prior to mobilisation.

10.9.4.1.7 Potential Risk Reduction Measures to Achieve Low-Risk Status

As described in Section 10.9.4.1.6, if the vessel is classified as a low-risk status, no additional management is required. For vessels classified as uncertain– or high–risk, the vessel operator is to undertake risk reduction measures either guided by an IMS inspector or identified to achieve a low–risk status and reduced to ALARP. Risk reduction measures may include but are not limited to:

- inspection (desktop, in-water or dry dock) by an industry recognised IMS inspector using the industry recognised risk assessment tool to understand and verify the actual biofouling risk
- in-water cleaning
- dry dock cleaning
- internal seawater systems treatment
- reject the vessel.

10.10 Non-Conformance Management

Shell classifies non-conformances with EPOs and EPSs in this EP as environmental incidents. Shell employees and contractors are required to report all environmental incidents, and these are managed by Shell's internal event

[92] The Maritime and Aircraft Reporting System (MARS) and the Vessel Compliance Scheme (VCS) - DAFF

recording, investigation and learning requirements. An internal computerised database called Sphera is used to record, track and report these incidents. Details of the event, immediate action taken to control the situation, investigation outcomes and corrective actions to prevent reoccurrence are all recorded. Corrective actions are monitored using Sphera and closed out in a timely manner.

10.11 Review

10.11.1 Management Review

The S&E Manager (Asset) regularly sponsors the monitoring and review of environmental performance and effectiveness of managing environmental risks and performance through team discussions, reporting and meetings. Several forms of management reviews exist to provide additional insight and overview of management system performance. These consist of, but are not limited to, the following:

- Steering Committees

  Steering Committees exist to provide oversight over specific processes, projects, or business activities. Steering Committees will be formed and modified over time as required to meet the needs of the business. Each of the committees has a Terms of Reference defining the scope and objectives of operation. Examples of such steering committees are the AIPSM Steering Committee and the Goal Zero Meeting.

- Annual Review Processes

  An annual review of effectiveness and compliance with the SEAM Standards and the EP is completed on an annual basis. This includes an assessment of relevant records required as evidence of effectiveness and compliance, any effectiveness and compliance issues and progress of any actions required to address these issues. Areas of concern and improvement identified at a management system level are managed through the development of appropriate improvements plans as required.

  An output summary of the annual reviews is used as input in the Country HSSE Management Review along with other Shell assets.

10.11.2 Knowledge Management

To manage the information and knowledge that underpins this EP (and other Shell EPs), Shell will implement an Environmental Knowledge Management Process. The process involves the periodic review of EP knowledge against updated information (available to Shell or made publicly available) to identify any gaps or inconsistencies. The source of new information may include (but is not limited to):

- Outcomes of Shell monitoring, surveys, or other studies as relevant to the EP content.
- Published studies and/or literature relevant to the EP content.
- Legislation databases and government guidelines, policies etc.
- Technical details, operational changes or other information on the project and facilities as relevant to the EP content.
- Outcomes of consultation as relevant to the EP content.

If new information is available, Shell will consider the new information in accordance with the internal Management of Change processes.

Learning and knowledge sharing also occurs via different methods including event investigations, HSSE bulletins, ongoing communication with contractors, cross asset learnings, engineering and technical authorities discipline communications and sharing, and review of impacts, risks, and controls across the life of the EP.

10.11.3 Continuous Improvement

As illustrated in the sections above, the Management System processes and the system itself are subject to a continuous improvement loop where findings from monitoring, assurance, and review activities are fed back to improve effectiveness. Another important driver for improvement is the review, analysis and learning from incidents.

Continuous improvement will be driven by:

- Improvements driven by the review of business-level HSSE key performance indicators.
- Actions arising from Shell's SEAM standards and updates to these standards as they occur.
- Corrective actions from HSE audits and inspections, incident investigations and on-site learnings, including after-action reviews.
- Opportunities for improvement and changes that are identified during operations and through both pre-activity and post-activity reviews and Management of Change documents.
- Actions taken to address any objections or claims, and issues raised during the ongoing consultation process (Section 5).

10.12 Reporting

Shell will implement various reporting measures to meet EPOs and EPSs committed in this EP.

10.12.1 Routine Reporting (Internal)

10.12.1.1 Shift/Progress Reports

The following daily reports will contain environmental performance information as relevant:

- Daily reports for relevant contract activities provide performance information about health, safety, and environment, and current and planned work activities. This will include well completions and major maintenance scope contractors.
- End of Shift Reports – includes facility performance information on production and a log of any HSSE events during operations.
- Daily Progress Report(s) – during some activities (such as subsea IMR), daily reports are issued by the site representative. The reports provide performance information on HSE events, diesel use, together with equipment information, current and planned work activities.

Meetings between key personnel are used to transfer information, discuss incidents, agree plans for future activities and develop plans and accountabilities for resolving issues.

10.12.1.2 HSSE Meetings

Regular dedicated HSSE meetings are held with the offshore and office-based management and advisers to address targeted incidents and initiatives. Minutes of these meetings are produced and distributed as appropriate.

10.12.2 Routine Reporting (External)

10.12.2.1 Environmental Performance Report

Shell will deliver to NOPSEMA an annual environmental performance report for compliance with this EPs EPOs and EPSs on an annual financial year basis (1 July–30 June) submitted by 31 December of each year.

10.12.2.2 Start and End Notifications

In accordance with Section 54 of the OPGGS(E) Regulations, Shell will notify NOPSEMA of the commencement of Petroleum Activities at least ten days before the activity commences, and the completion within ten days of activity completion.

10.12.2.3 Environmental Performance Reporting

In accordance with applicable environmental legislation for the activity, Shell is required to report information on environmental performance to various regulators. Regulatory reporting requirements are summarised in Table 10-10.

Table 10-10: Routine External Reporting

Reporting Requirement	Description	Recipient	Frequency
Monthly Recordable Incident Reports	Details of recordable incidents that have occurred during the Petroleum Activities for previous month (if any). Complete NOPSEMA Recordable Environmental Incident Monthly Report form (N-03000-FM0928)[93]. Section 50 OPGGS(E) Regulations.	NOPSEMA	Monthly, by 15th of each month
Annual Environment Plan Performance Report	Compliance with EPOs, controls, and standards outlined in this EP, in accordance with the OPGGS(E) Regulations. Report to include: • summary of activities undertaken throughout the reporting period (previous Financial Year) • sufficient information to determine compliance with EPOs and standards. Sections 51(1) and 22(7) OPGGS(E) Regulations.	NOPSEMA	Annual, by 31 December each year.
National Pollutant Inventory (NPI) Report	Summary of the emissions to land, air, and water including those from the facility. Reporting period 1 July to 30 June each year.	DCCEEW	Annual, by 30 September each year
National Greenhouse and Energy Reporting (NGER)	Summary of energy use and GHG emissions including those from the facility. Reporting period is 1 July to 30 June each year.	Clean Energy Regulator (CER)	Annual, by 31 October each year

10.12.3 Non-Routine Notifications (External)

In accordance with applicable environmental legislation for the activity, Shell is required to notify governments, regulators, and agencies regarding information on environmental performance or activity to various regulators. Non-routine external notification requirements are summarised in Table 10-11, where applicable to activities.

Table 10-11: Non-routine External Notifications

Reporting Requirement	Description	Recipient	Frequency
Pre activity (where relevant)			
Notify NOPSEMA that the activity has started.	Complete NOPSEMA start or end of activity form (N-04750-FM1405). Section 54(1) OPGGS(E) Regulations.	NOPSEMA	Notification at least 10 days before the activity commences and no later than 10 days after the activity ends.
Notify the department of the responsible WA or NT Minister of the	Notify activity commencement date, where relevant. Section 55 OPGGS(E) Regulations.	Minister's Department	Before the activity commences.

[93] https://www.nopsema.gov.au/document-hub/forms-and-templates

Reporting Requirement	Description	Recipient	Frequency
proposed commencement date.			
DAFF Biosecurity requirements.	Submit pre-arrival report and ballast water report using Maritime Arrivals Reporting System (MARS). Online forms[94] for vessels arriving from international waters where applicable to meet DAFF's biosecurity reporting obligations pursuant to the *Biosecurity Act 2015* (Cth) and the Biosecurity (Exposed Conveyances – Exceptions from Biosecurity Control) Determination 2016, undertake a vessel biosecurity risk and be assessed as 'low' by DAFF before interacting with domestic vessels and aircraft.	DAFF	Within 12–96 hours before vessel arrives into Australian waters.
AMSA including Joint Rescue Coordination Centre (JRCC) Notification.	Notify activity commencement date and duration.	AMSA (RCC)	Within 24–48 hours before vessel activities commence.
AHO Notification.	Notify activity commencement date and duration.	AHO	At least 4 weeks before the activity commences.
During activity			
AMSA including JRCC notification.	Activity updates, particularly changes to previously communicated operations.	AMSA (RCC)	As soon as possible.
AHO notification.	Activity updates, particularly changes to previously communicated operations.	AHO	As soon as possible.
Tuna Australia	Notification prior to the commencement of Crux gas.	Tuna Australia	3–5 business days prior to commencing the processing of Crux gas
End of Activity (where relevant)			
Notify NOPSEMA that the activity is completed.	Complete NOPSEMA's start or end of activity form (N-04750-FM1405). Section 54(2) OPGGS(E) Regulations.	NOPSEMA	Within 10 days after activity completion.
AMSA including JRCC notification.	Notify activity has been completed.	AMSA (RCC)	Within 10 days after completion.
AHO notification.	Notify activity has been completed.	AHO	Within 10 days after completion.
End of operations of an EP notification.	Complete NOPSEMA's Regulation 46 – End of operation of environment plan form (N-04750-FM1408). Section 46 OPGGS(E) Regulations.	NOPSEMA	After completing all obligations under this EP.
Environmental Performance Report – End of Activity.	Report to include:	NOPSEMA	To be submitted following the 'end of

[94] https://www.agriculture.gov.au/biosecurity-trade/aircraft-vessels-military/vessels/mars

Reporting Requirement	Description	Recipient	Frequency
	• summary of activities undertaken throughout the final reporting period. • sufficient information to determine compliance with EPOs and standards. Sections 51(1) and 22(7) OPGGS(E) Regulations.		activity' notification being submitted.

10.12.4 Incident Reporting

The Shell Australia HSSE Event Investigate and Learn Procedure, which is applicable to all activities outlined in this EP, has been established to describe the process of reporting, classification, investigation, follow-up and close out of all HSSE and SP incidents on Prelude. Follow-up includes analysis, recommendations, implementation, and communication of learnings and continuous improvement of this process. This HSSE process is referenced within the HSSE Management Manual and is supported by Shell's internal use of Sphera (discussed in Section 10.10).

The procedure is used to ensure that all incidents (including near misses, unsafe acts and conditions) are reported, investigated and analysed in a consistent manner. Investigations focus on the identification of causes using casual (or positive) reasoning techniques. Investigation depth and breadth are proportional to the actual and potential consequences of the incident. There is a focus on identifying and implementing corrective actions that will eliminate causes and prevent recurrence of similar type of incidents.

The notification and reporting of incidents to NOPSEMA (and other regulatory bodies) is done in accordance with the relevant notified bodies regulations. For all NOPSEMA notifications for reportable incidents see Section 10.12.4.1.

10.12.4.1 Recordable Incidents

A 'recordable incident' is defined by the OPGGS(E) Regulations as a 'breach of an environmental performance outcome (EPO) or environmental performance standard (EPS), in the EP that applies to the activity, that is not a reportable incident'. Shell has processes in place that ensure it will notify NOPSEMA of all Recordable Incidents, according to the requirements of Section 50 of the OPGGS(E) Regulations and reported as detailed in Table 10-10. The report will include:

- A record of all Recordable Incidents that occurred during each calendar month that the activity (EP) is in force.
- All material facts and circumstances concerning the Recordable Incidents that the operator knows or is able, by reasonable search or enquiry, to find out.
- Any action taken to avoid or mitigate any adverse environment impacts of the Recordable Incidents.
- The corrective action that has been taken, or proposed to be taken, to stop, control or remedy and to avoid a repeat of the Recordable Incident.
- The action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in future.

10.12.4.2 Reportable Incidents

A 'reportable incident' is defined by the OPGGS(E) Regulations as 'an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage'. Under Section 47 of the OPGGS(E) Regulations, NOPSEMA is to be notified in the event of a reportable incident within two hours after the occurrence of the environmental incident (see Table 10-12). Under Section 48 of the OPGGS(E) Regulations, Shell will provide a written report within three days of the reportable incident.

The Shell Environmental Risk Matrix (Section 9.1) uses magnitude criteria +1 to −5 to define environmental consequences (positive impact [+1], no impact [0], slight effect [−1], minor effect [−2], moderate effect [−3], major effect [−4] and massive effect [−5]) (refer to Table 9-3). All environmental events/incidents with an actual or potential magnitude ≥−3 (i.e. moderate effect, major effect and massive effect) are considered reportable incidents.

Based on the risk assessment (Section 9), the following events/incidents are classified as having an actual consequence magnitude ≥3 (i.e. moderate effect, major effect and massive effect) and are therefore considered to be example (not an exhaustive list) of reportable incidents:

- Confirmed introduced marine pest species in Australian waters attributable to the activities (Table 9-43)
- Emergency event (hydrocarbon release) (Table 9-121).

The potential for an event/incident to have an environmental consequence magnitude ≥3 is assessed as part of the Environmental Risk Assessment which is conducted in Sphera for each event/incident. The assessment is conducted using the Shell Environmental Risk Matrix and considers the 'worst case credible' consequence that could develop from the event/incident under the prevailing conditions. Any event/incident that is assessed as having the potential to result in a consequence magnitude ≥−3, will also be considered a reportable environmental incident.

The reportable incident report will contain all material facts and circumstances concerning the reportable incident, actions taken to avoid and/or mitigate any adverse impacts and corrective action taken, including learnings. This report will be submitted to NOPSEMA as soon as practicable after the oral notification. Table 10-12 outlines the reporting requirements for reportable incidents. Table 10-13 lists other externally notifiable incidents. Additional notification requirements relevant to oil spill incidents are included in the BROPEP.

Table 10-12: Notifying and Reporting Reportable Incidents

Reporting Requirement	Recipient	Submission Timing
Section 47 of the OPGGS(E) Regulations: Notification of reportable incidents		
The oral notification must contain: • all material facts and circumstances concerning the reportable incident known or by reasonable search or enquiry could be found out by the Titleholder. • any action taken to avoid or mitigate any adverse environmental impacts of the reportable incident. • the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident.	NOPSEMA[95]	Within 2 hours after the first occurrence of a reportable incident, or if the incident was not detected at the time of the first occurrence, at the time of becoming aware of the reportable incident.
A written record of the oral notification must be submitted. The written record is not required to include anything that was not included in the oral notification.	NOPSEMA NOPTA[96] Department of the responsible WA or NT Minister.	As soon as practicable after the oral notification.
Section 48 of the OPGGS(E) Regulations: Written report of reportable incidents		
A written report must contain: • all material facts and circumstances concerning the reportable incident known or by reasonable search or enquiry could be found out. • any action taken to avoid or mitigate any adverse environmental impacts of the reportable incident. • the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident. • the action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future.	NOPSEMA	Must be submitted as soon as practicable, and in any case not later than 3 days after the first occurrence of the reportable incident unless NOPSEMA specifies otherwise.
	NOPTA Department of the responsible WA or NT Minister.	Must be submitted within 7 days after giving the written report to NOPSEMA.

[95] To make an oral notification to NOPSEMA of a reportable environmental incident call: 1300 674 472.

[96] reporting@nopta.gov.au

Reporting Requirement	Recipient	Submission Timing
NOPSEMA's Report of an Accident, Dangerous Occurrence or Environmental Incident form (N-03000-FM0831).	NOPSEMA	Within 3 days after the first occurrence of the reportable incident unless NOPSEMA specifies otherwise.

10.12.4.3 Incident Notifications

Table 10-13: Externally Notifiable Incidents

Reporting Requirement	Recipient	Submission Timing
Any hydrocarbon spill that has entered or is likely to enter international waters.	DISR will notify DFAT who will notify the relevant foreign government. 02 6213 6000 opicc@industry.gov.au	Verbal notification within 8 hours, if the spill is likely to extend into international waters.
	DFAT	Follow up with email outlining details of incident.
Hydrocarbon spill within a marine park or likely to impact on a marine park.	DNP (Marine Park Compliance Duty Officer) 0419 293 465	As soon as possible.
Any oil spill or discharge of any pollutant which may impact WA managed fish breeding or fish stocks.	DPIRD environment@dpird.wa.gov.au	Within 24 hours.
Any confirmed introduced marine pest species in WA waters.	DPIRD (FishWatch) 1800 815 507 aquatic.biosecurity@dpird.wa.gov.au	Within 24 hours.
	DPIRD (Aquatic Pest Biosecurity) 08 9203 0111 aquatic.biosecurity@dpird.wa.gov.au	
Any ship strike incident with cetaceans.	DCCEEW (Australian Antarctic Division, Australian Marine Mammal Centre) Report to the National Ship Strike database[97]:	As soon as possible but no later than 72 hours.
Death or injury of EPBC Act listed threatened, migratory, marine or cetacean species.	DCCEEW EPBC.permits@environment.gov.au	Within 7 days, including the time, place, circumstances, species affected and the consequences of the action.
	NOPSEMA Secure File Transfer service or by email to submissions@nopsema.gov.au	
Any sighting and entanglements of a cetacean.	DCCEEW (Australian Antarctic Division, Australian Marine Mammal Centre)[98].	Within 2 months.
Vessel spill to marine environment: including all discharges/spills or probable discharges/spills to the marine environment of oil or oily mixtures, or	AMSA JRCC 1800 641 792 rccaus@amsa.gov.au	Within 2 hours of incident.

[97] https://data.marinemammals.gov.au/report/shipstrike

[98] sightingsdata@aad.gov.au

Reporting Requirement	Recipient	Submission Timing
noxious liquid substances in the marine environment from vessels: Report vessel spills that are released to the marine environment.		
Marine pollution incidents in NT waters.	NT Department of Environment, Parks and Water Security (Territory Emergency Management Council). 1800 064 567 pollution@nt.gov.au	Verbal notification as soon as practicable. Pollution report (POLREP) (Harmful Substances Report -oil), within 24 hours. Situation report (SITREP), as required.
Hydrocarbon spill predicted to enter NT waters.	NT Department of Environment, Parks and Water Security (Territory Emergency Management Council (TEMC)). 1800 064 567 pollution@nt.gov.au	Verbal notification as soon as practicable. POLREP (Harmful Substances Report -oil), within 24 hours SITREP, as required.
Hydrocarbon spill predicted to enter WA waters.	WA DoT (Maritime Environmental Emergency Response) Chief Executive Officer (CEO) of the WA DoT (Hazard Management Agency [HMA]). 08 9480 9924 (24 hours) Marine.pollution@transport.wa.gov.au	Verbal notification as soon as practicable. POLREP (Harmful Substances Report – oil), within 24 hours SITREP, as required.
	DBCA's Kimberley regional office via phone (08) 9195 5500 DBCA via email EMBAdmin@dbca.wa.gov.au.	As soon as practicable, if the spill is likely to extend into WA state waters.
Marine pollution incidents in WA waters.	HMA–CEO of the WA DoT (Maritime Environmental Emergency Response). 08 9480 9924 (24 hours) marine.pollution@transport.wa.gov.au	As soon as practicable.
Marine POLREP[99] and (SITREP).	AMSA Rescue Coordination Centre (RCC). rccaus@amsa.gov.au and WA DoT marine.pollution@transport.wa.gov.au	As requested by WA DoT and AMSA following verbal notification.
Notification detailing any Level/Tier 2 or 3 hydrocarbon spill which has the potential to impact communities and environment. The notification to contain:	NLC Relevant Persons contact details as held in Shell's relevant persons consultation database.	Immediately following establishment of potential impacts.

[99] www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf.

Reporting Requirement	Recipient	Submission Timing
• all material facts and circumstances concerning the incident (including emergency response timeframes and expected environmental impacts) • actions taken to avoid or mitigate any adverse impacts. • corrective actions taken.		
Notification detailing any Level/Tier 2 or 3 hydrocarbon spill which has the potential to impact each Tier 1 and Tier 2[100] Indigenous Relevant Persons functions, interests or activities. The notification to contain: • all material facts and circumstances concerning the incident (including emergency response timeframes and expected environmental impacts). • actions taken to avoid or mitigate any adverse impacts. • corrective actions taken.	Relevant Persons contact details as held in Shell's Relevant Persons consultation database.	Immediately following establishment of potential impacts to Relevant Persons functions, interests, or activities.
Notification to WAFIC detailing any Level/Tier 2 or 3 hydrocarbon spill which has the potential to impact on WA fisheries. The notification is to include: • all material facts and circumstances concerning the incident (including emergency response timeframes and expected environmental impacts). • Actions taken to avoid or mitigate any adverse impacts. • Corrective actions taken. WAFICs contact details (email) as held in Shell's Relevant Persons consultation database. Submission Timing Within 24 hours of Incident. Shell IMT would like to utilise WAFIC's fee for a service to contact any potentially impacted commercial fishing licence holders in the event of an emergency scenario.	WAFICs contact details (email) as held in Shell's Relevant Persons consultation database.	Within 24 hours of Incident.
Quarantine regulations breach.	DAFF (National Maritime Centre) 1300 004 605 maritimenc@aff.gov.au	As soon as practicable.

10.13 Details of Titleholder and Liaison Person

In accordance with Section 23 of the OPGGS(E) Regulations, details of the titleholder, liaison person and arrangements for notifying changes are described below.

Titleholder:

Shell Australia Pty. Ltd. (ACN/ABN: 009663576/14009663876)

562 Wellington Street, Perth 6000 WA

Activity Contact:

[100] Tiers as defined in Table 5-10.

Brendan Herbst

Vice President Prelude-Crux

Email: SDA-preludeflng@shell.com

Phone: 1800 059 152

If the titleholder, titleholder's nominated liaison person or the contact details for either change, Shell will notify NOPSEMA in writing of the change within two weeks or as soon as practicable.

10.14 Record Keeping

Compliance records will be maintained. Record keeping will be in accordance with Section 52(7) of the OPGGS(E) Regulations, which addresses maintaining quantitative records of emissions and discharges, environmental performance, monitoring, and calibration of devices that are made in accordance with the EP in force for an activity under the title that are accurate and can be monitored and audited against the environmental performance standards and measurement criteria.

10.15 Emergency Preparedness and Response

Under Section 22(8) of the OPGGS(E) Regulations, the Implementation Strategy must contain an OPEP and provisions for updating it throughout the activity. Section 22(9) of the OPGGS(E) Regulations outlines the OPEP requirements, which must include adequate arrangements for timely response to and monitoring of an oil pollution event. A summary of Shell Australia's emergency and incident management framework and arrangements are described in the following sections.

10.15.1 Emergency Management Manual

Shell's Emergency Management Manual (HSE_GEN_010996) provides a tiered response framework that classifies incidents based on the level of resourcing and support required. It also outlines communication arrangements associated with each level of emergency, emergency response roster arrangements, emergency response training and competencies, and requirements for emergency management drills and exercises.

10.15.2 Incident Management Team (West) Emergency Response Plan

The IMT(W) ERP (HSE_GEN_011209) is a supporting document to the Shell Australia Standard Emergency Management Manual (HSE_GEN_010996) and is consistent with national and state emergency management arrangements. The IMT(W) ERP (HSE_GEN_011209) provides specific assistance and guidance to the IMT(W) in support of Shell-owned, operated, or contracted facilities. This ERP contains these details:

- Emergency and incident management plans and arrangements.
- IMT(W) role checklists and duty cards.
- Incident management, action planning, Incident Command System (ICS) forms and briefing templates.
- IMT(W) communications.
- Guidance and forms for responding to emergencies.
- Lists of supporting SME units.
- De-escalation and recovery.

10.15.3 Oil Pollution Emergency Plan

The Shell Browse Regional Oil Pollution Emergency Plan (BROPEP) (HSE_GEN_016765) outlines emergency management arrangements to respond to credible spill scenarios associated with all offshore activities in the Browse Region, including the Prelude FLNG, the Crux Platform and the associated pipeline between Prelude and Crux. The BROPEP provides the information and reference to documents required for an effective response in the unlikely event of an unplanned release of petroleum products. The BROPEP details the actions to be taken in response to the incident and provides contact details of emergency specialist response groups, statutory authorities and other external bodies requiring notification.

10.15.4 Operational and Scientific Monitoring Framework

Shell is required to have in place arrangements for monitoring oil pollution as part of its BROPEP. Shell has adopted the use of the Joint Industry OSMP (APPEA 2021a) and its associated OMPs and SMPs to guide environmental monitoring that may be implemented in the event of a Level/Tier 2–3 spill of hydrocarbons. Further information on how the Joint Industry OSMP Framework interfaces with Shell's activities, spill risks and internal management systems is presented in Shell's Browse Regional Operational and Scientific monitoring Bridging Implementation Plan (HSE_PRE_016370).

10.15.5 WAFIC Loss Adjustment

In response to consultation with WAFIC, the adjustment protocols developed and included in the NERA Collaboration EP (taken to mean the NERA Collaborative Seismic Environment Plan) will be applied in the event of an unplanned spill or introduction of IMS. Shell refers to Appendix D3 (page 622) of the NERA Collaborative Seismic Environment Plan (Revision 1) as information previously given under Section 56(1) of the OPGGS(E) Regulations. The full text NERA Collaborative Seismic Environment Plan is available on the NOPSEMA Environment Plans website (https://info.nopsema.gov.au).

10.15.6 Shell Australia's Emergency Management Structure

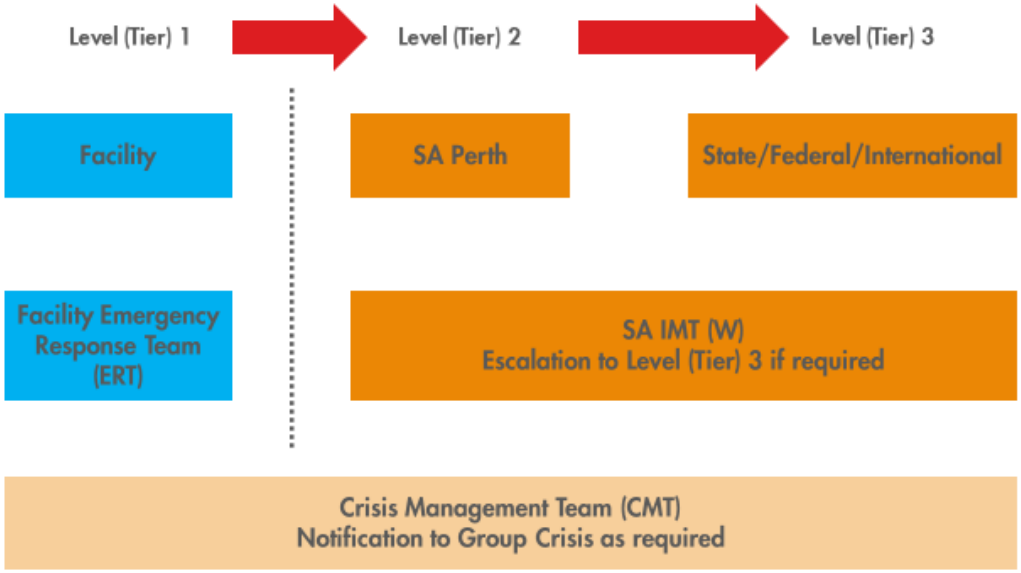
Shell Australia applies the ICS methodology for emergency management. The ICS is designed to manage incidents by integrating facilities, equipment, personnel, procedures, and communications operating under one structure. An ICS is commonly structured into functional areas that facilitate incident management activities, including operations, planning, logistics, finance, and incident command.

Shell also applies a graduated response framework that increases resource involvement based on the significance and escalation potential of the incident. This graduated framework involves three key emergency management teams:

- Emergency Response Team (ERT), which is based on the facility and is responsible for the initial response to the incident. The Facility Incident Commander will liaise closely with the onshore IMT(W) leader and will identify when additional support is required to respond to an incident.
- IMT(W), which is based onshore within the Perth Shell office will support the ERT by providing advice, logistical and asset support and managing the operational and technical aspects of the response with knowledge and technical support from Shell's Global Response Support Network (GRSN).
- Crisis Management Team (CMT), which is also based onshore in Australia, is responsible for the overall management of the incident from a strategic, commercial, legal, reputational, and high-level liaison perspective with knowledge and technical support from Shells GRSN.

The ERT and IMT(W) are scalable to the nature and scale of the response (i.e. one person can take on multiple roles where circumstances permit and vice versa). The mobilisation of the ERT is at the directive of the Facility Incident Commander or delegate. To mobilise the IMT(W), the Facility Incident Commander contacts the on-duty IMT(W) Leader who will then mobilise the IMT(W) as the situation warrants. Duty positions within the IMT(W) area are staffed by a roster system where each position has required personnel identified for the role. On-call positions within the IMT(W) provide specific functional expertise that helps the business respond to relevant incident scenarios. On-call positions are activated as part of the IMT(W) at the discretion of the IMT(W) Leader based on known or potential requirements. Several people are identified and trained for each on-call position, with a rotating on-call list used to contact these personnel.

Figure 10-20 outlines the emergency management escalation process adopted by the IMT(W); Figure 10-21 shows the IMT(W) structure.



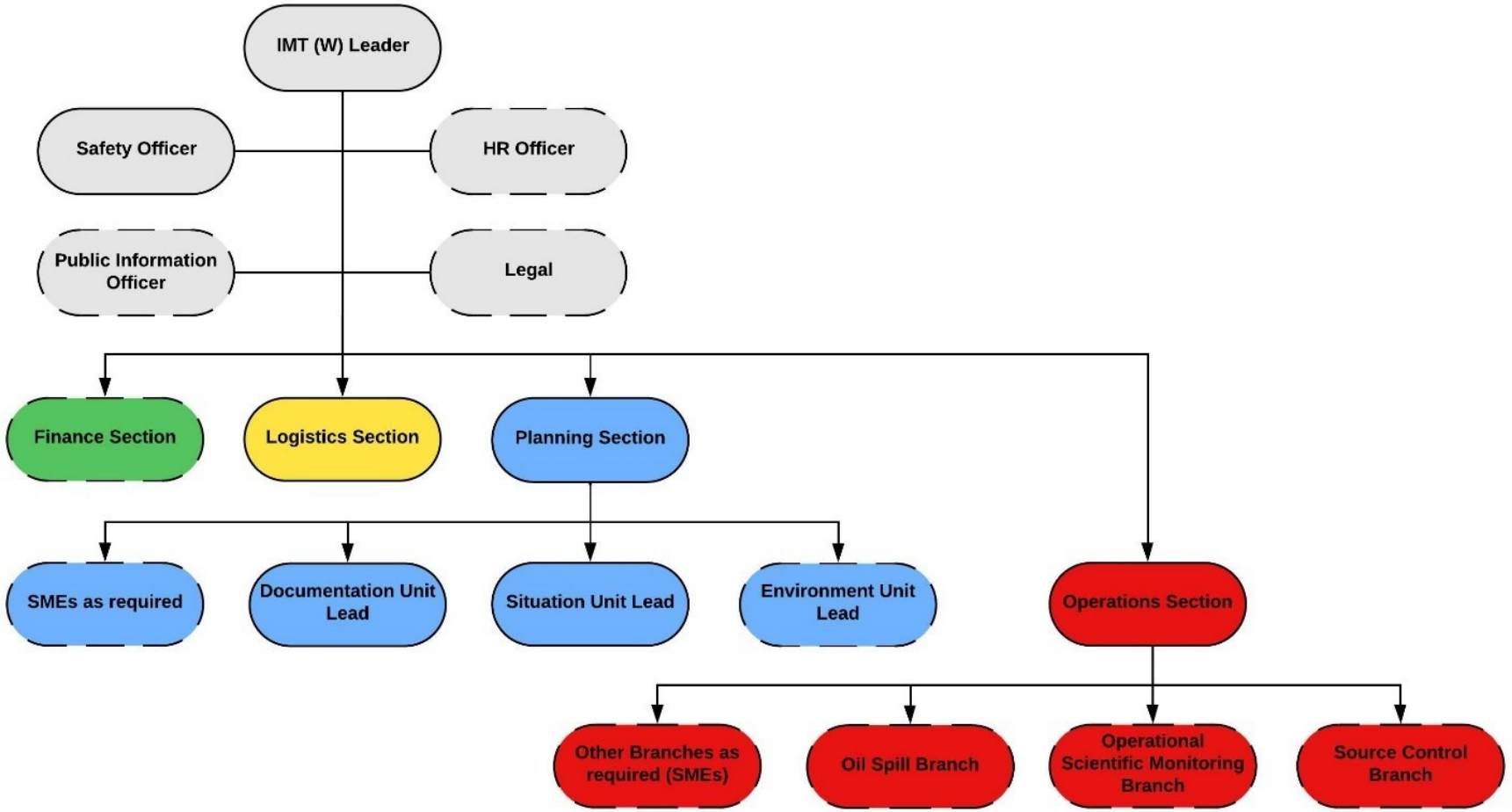
SA = Shell Australia

Figure 10-20: Emergency Management Escalation Process Adopted by IMT(W)

Interface between the IMT and CMT is outlined in the Shell Australia Weekly Contact List (HSE_GEN_011648). The affected facility business executive will be notified by the IMT (W) leader and IMT (W) will notify the Shell Australia CMT leader.

In addition to these resources, Shell Australia can activate additional support through the Shell GRSN. The GRSN is a network of emergency response trained Shell Staff employed in a wide range of positions within Shell's global and local businesses who have received specific training related to oil spill response and who may be called upon to support any business or Country globally which is responding to a large-scale incident. Shell Australia also has access to the Well Control Virtual Emergency Response Team (WCVERT) to provide virtual or physical mobilisation of a wide range of technical expertise to support an emergency event.

Shell Australia could also activate external additional resources for Level/Tier 2–3 spills to fill various ERT and IMT roles for the duration of the response if they were required. This includes oil spill response organisation personnel and trained mutual aid personnel (as per AMOS Plan), as outlined in the BROPEP (HSE_GEN_016765).



Solid lines indicate on call duty roles; all other positions are to be activated as required.

Figure 10-21: Incident Management Team (West) Structure

10.15.7 Emergency Management Roles and Responsibilities

Shell's IMT(W) ERP (HSE_GEN_011209) and Prelude Facility ERP provide detailed guidance on the roles and responsibilities for all emergency management personnel.

Table 10-14 outlines the key incident response roles and responsibilities for Shell personnel. Table 10-15 outlines the roles and responsibilities of Shell personnel who are required to work within the WA DoT organisational structure, where WA DoT has responsibilities for spill response as a control agency, as per their Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements. WA DoT will provide two roles to Shell's IMT (W)/CMT in a coordinated response; their roles and responsibilities are listed in Table 10-16.

Table 10-14: Summary of Roles and Responsibilities of Key Emergency Management Personnel

Key Roles	Responsibilities
Facility Incident Commander (Offshore)	• Maintain the safety of all Prelude and Crux personnel and initiate actions to protect the environment and assets. • Ensure all first-strike actions are carried out as per the BROPEP. • Control source of spill (if practicable). • Classify the Level/Tier of spill. • Notify and maintain regular communications with IMT(W) Leader of incident. • Verbally notify NOPSEMA (within 2 hours of spill) if spill is within Commonwealth Waters. • Initiate surveillance, modelling and visualisation activities, as per the BROPEP.
On-scene Commander (Offshore)	• Responsible for coordinating the emergency scene and the safety of all personnel at the emergency scene. • Move ERT forward when authorised by the Facility Incident Commander. • Provide regular situation updates to the Operations Section Chief (OSC) on incident progress against response plan priorities.
IMT(W) Leader (Onshore)	• Activate IMT, if required. • Ensure all first-strike actions are carried out as per the BROPEP. • Conduct overall management of incident response operations. • Assess the situation and confirm or adjust the spill classification Level/Tier in consultation with the OIM and OSC. • Notify CMT Leader of event and initial response level. • Determine incident priorities and objectives for IMT. • Confirm Incident Action Plan (IAP) is being developed; approve and authorise implementation of IAPs. • Confirm all external notifications and reporting have been made, as outlined in the BROPEP. • Mobilise external support, if required, as per the BROPEP.
Operations Section Chief (OSC) (Onshore)	• Oversee all operational resources and activities supporting an emergency. • Establish communications with ERT. • Provide overview of response operations at initial IMT briefing. • Communicate incident updates provided by the ERT to IMT through meetings and team briefings. • Provide incident details to the Planning Section Chief (PSC) and Situation Unit Lead for developing the initial IAP and help develop incident objectives and strategies. • Determine Activity Areas (e.g. staging areas, forward command, incident area, oiled wildlife receiving, and demobilisation areas). • Execute IAPs for each operational period. • Responsible for safety of all personnel involved in response.

Key Roles	Responsibilities
Planning Section Chief (PSC) (Onshore)	• Facilitate all IMT meetings. • Help the IMT(W) Leader develop incident objectives. • Facilitate development of IAP for next operational period. • Mobilise Environment Unit. • Monitor situation reports and update status displays with additional information; adjust IAP as necessary.
Logistic Section Chief (LSC) (Onshore)	• Source all logistical requirements to complete response operations, including personnel, equipment and supplies for ongoing incidents. • Liaise with PSC on specialist resource requirements being considered in response strategies; verify availability of these resources as this may affect strategy selection. • If required incident resources are not immediately available through existing contracts, liaise with Contracts and Procurement to develop contractual arrangements as required.
Environment Unit Lead (EUL) (Onshore)	• Conduct relevant external notifications, as outlined in the BROPEP. • Review OMP initiation criteria and activate OSMP contractor where required. • Confirm protection priorities. • Validate strategic SIMA and generate the initial operational SIMA. • Provide the OSC with guidance on environmental management measures to be followed during response operations.
Situation Unit Lead (Onshore)	• Responsible for collecting, processing and organising incident information relating to the growth, mitigation or intelligence activities taking place on the incident. • Manage all situational awareness and intelligence information relating to the incident, including geospatial/meteorological information. • Ensure status boards are updated, retain clear records of out-of-date vs current information. • Prepare and disseminate resource and situation status information as required, including special requests.
Documentation Unit Lead (Onshore)	• Responsible for maintaining accurate, up-to-date incident files (i.e. IAP, incident reports, communications logs). • Compile and collate all unit logs, communications, and other records so that a consolidated set of incident documentation is maintained. • Liaise with the Situation Unit Lead to collate and store all relevant documentation produced for Situation Updates.
External (Government) Relations/Public Information Officer (Onshore)	• Conduct relevant external notifications, as outlined in the BROPEP. • Manage all external communications until CMT assumes responsibility. • Evaluate the need for a joint information communication centre. • Ensure active and ongoing engagement with all relevant p and external response agencies; prepare stakeholder management plan for approval by IMT. • Develop material for use in media releases.
Safety Officer (Onshore)	• Conduct hazard assessment and advise OIM of recommended safety actions and safe approach routes. • Assist the OSC and LSC by facilitating risk assessments during event response and recovery plan development, as required. • Review IAPs for safety implications.
Finance Section Chief (Onshore)	• Responsible for all financial, administrative, and cost analysis aspects of an emergency. • Provide financial and cost analysis information as requested.

Table 10-15: Shell Personnel Roles Positioned within the State Maritime Environmental Emergency Coordination Centre (MEECC)/WA DoT IMT

Key Roles	Responsibilities
Crisis Communications Support Team Liaison Officer	• Provide a direct liaison between Shell and the State MEECC. • Facilitate effective communications and coordination between the Shell CMT Leader and the State Maritime Environmental Emergency Coordinator (SMEEC). • Advise SMEEC on matters pertaining to Shell's crisis management policies and procedures.
Deputy Incident Officer	• Provide a direct liaison between the WA DoT IMT and the Shell IMT. • Facilitate effective communications and coordination between the Shell IMT(W) Leader and the WA DoT Incident Controller. • Advise the WA DoT Incident Controller on matters pertaining to Shell's incident response policies and procedures. • Advise the Safety Coordinator on matters pertaining to Shell's safety policies and procedures particularly as they relate to Shell employees or contractors operating under the control of the WA DoT IMT.
Intelligence Support Officer	• As part of the Intelligence Team, assist the Intelligence Officer in the performance of their duties in relation to situation and awareness. • Facilitate the provision of relevant modelling and predictions from the Shell IMT. • Help interpret modelling and predictions originating from the Shell IMT. • Facilitate the provision of relevant situation and awareness information originating from the WA DoT IMT to the Shell IMT. • Facilitate the provision of relevant mapping from the Shell IMT. • Help interpret mapping originating from the Shell IMT. • Facilitate the provision of relevant mapping originating from the Shell IMT.
Deputy Planning Officer	• As part of the Planning Team, help the Planning Officer perform their duties in relation to interpreting existing response plans and developing IAPs and related subplans. • Facilitate the provision of relevant IAPs and subplans from the Shell IMT. • Help implement the Shell BROPEP. • Help develop the Shell IAPs and subplans from the Shell IMT. • Facilitate the provision of relevant IAPs and subplans originating from the WA DoT IMT to the Shell IMT. • Help interpret Shell's existing resource plans. • Facilitate the provision of relevant components of the resource subplan originating from the WA DoT IMT to the Shell IMT. • (Note: The Deputy Planning Officer must have intimate knowledge of the Shell BROPEP and planning processes).
Environmental Support Officer	• As part of the Planning Team, help the Environmental Officer perform their duties in relation to providing environmental support into the planning process. • Help implement the Shell BROPEP and relevant TRP plans. • Facilitate in requesting, obtaining, and interpreting environmental monitoring data originating from the Shell IMT. • Facilitate the provision of relevant environmental information and advice originating from the WA DoT IMT to the Shell IMT.

Key Roles	Responsibilities
Public Information Support and Media Liaison Officer	• As part of the Public Information Team, provide direct liaison between the Shell media team and WA DoT IMT media team. • Facilitate effective communications and coordination between the Shell and WA DoT media teams. • Help release joint media statements and conduct joint media briefings. • Help release joint information and warnings through the WA DoT Information and Warnings team. • Advise the WA DoT Media Coordinator on matters pertaining to Shell media policies and procedures. • Facilitate effective communications and coordination between Shell and WA DoT Community Liaison teams. • Help conduct joint community briefings and events. • Advise the WA DoT Community Liaison Coordinator on matters pertaining to Shell's community liaison policies and procedures. • Facilitate the effective transfer of relevant information obtained from through the Contact Centre to the Shell IMT.
Deputy Logistics Officer	• As part of the Logistics Team, help the Logistics Officer perform their duties in relation to providing supplies to sustain the response effort. • Facilitate the acquisition of appropriate supplies through Shell's existing OSRL, AMOSC and private contract arrangements. • Collect Request Forms from WA DoT to action via the Shell IMT. • (Note: The Deputy Logistics Officer must have intimate knowledge of the relevant Shell logistics processes and contracts).
Deputy Operations Officer	• As part of the Operations Team, help the Operations Officer perform their duties in relation to implementing and managing operations activities undertaken to resolve an incident. • Facilitate effective communications and coordination between the Shell Operations Section and the WA DoT Operations Section. • Advise the WA DoT Operations Officer on matters pertaining to Shell's incident response procedures and requirements. • Identify efficiencies and help resolve potential conflicts around resource allocation and simultaneous operations of Shell and WA DoT response efforts.
Deputy Waste Management Coordinator	• As part of the Operations Team, help the Waste Management Coordinator perform their duties in relation to managing and disposing waste collected in State Waters. • Facilitate the disposal of waste through Shell's existing private contract arrangements related to waste management and in line with legislative and regulatory requirements. • Collect Waste Collection Request Forms from WA DoT to action via the Shell IMT.
Deputy Finance Officer	• As part of the Finance Team, help the Finance Officer perform their duties in relation to setting up and paying accounts for those services acquired through Shell's existing OSRL, AMOSC and private contract arrangements. • Facilitate the communication of financial monitoring information to Shell to allow them to track the overall cost of the response. • Help the Finance Officer track financial commitments through the response, including the supply contracts commissioned directly by WA DoT and to be charged back to Shell.

Key Roles	Responsibilities
Deputy On Scene Commander (Forward Operations Base (FOB))	• As part of the Field Operations Team, help the On Scene Commander perform their duties in relation to overseeing and coordinating field operations activities undertaken in line with the IMT Operations Section's direction. • Provide a direct liaison between Shell's FOB/s and the WA DoT FOB. • Facilitate effective communications and coordination between the Shell and WA DoT On Scene Commanders. • Advise the WA DoT On Scene Commander on matters pertaining to Shell's incident response policies and procedures. • Help the Safety Coordinator deployed in the FOB perform their duties, particularly as they relate to Shell employees or contractors. • Advise the Safety Coordinator deployed in the FOB on matters pertaining to Shell's safety policies and procedures.

Table 10-16: Roles and Responsibilities of WA DoT Personnel to be Positioned in Shell's IMT/CMT

Key Roles	Responsibilities
WA DoT Liaison Officer	• Facilitate effective communications between WA DoT's SMEEC and Incident Controller and Shell's CMT Leader and Incident Controller. • Provide enhanced situational awareness to WA DoT of the incident and the potential impact on State Waters. • Help provide WA DoT support to Shell. • Facilitate the provision of technical advice from WA DoT to Shell's Incident Controller, as required.
Media Liaison Officer	• Provide a direct liaison between Shell's media team and WA DoT's IMT media team. • Facilitate effective communications and coordination between Shell and WA DoT media teams. • Help release joint media statements and conduct joint media briefings. • Help release joint information and warnings through the WA DoT Information and Warnings team. • Advise the Shell Media Coordinator on matters pertaining to WA DoT and wider government media policies and procedures.

10.15.8 Emergency Management Exercises, Training and Competencies

Shell follows the approved ICS and IMO emergency management training requirement for ICS command and general staff. Specific competencies for IMT members are defined in the Shell Operational HSSE Competence Framework and are tracked in Workday Learning. Table 10-17 outlines the training requirements and core competencies for key ERT, IMT and CMT personnel. Table 10-18 outlines oil spill responder training requirements.

Only those who have completed all mandatory training requirements can be placed on the IMT roster. Training status of IMT personnel is reviewed monthly (or following significant personnel or policy change by the Emergency Response Coordinator) and notifications issued in advance to those requiring revalidation by training and/or emergency response exercise participation.

Table 10-17: Exercise and Training Requirements for Key ERT, IMT and CMT Personnel

Key Roles	Exercises	Training
ERT personnel	In accordance with vessel/asset emergency exercise schedule and SOPEP exercise schedule.	As specified via each respective contractor HSSE management system.
IMT personnel	80% of personnel must participate in an IMT exercise annually.	All IMT personnel: ICS 100, 200 and IMT induction.
IMT(W) Leader	80% of personnel must participate in an IMT exercise annually.	IMT(W) Leader: AMOSC – IMO3 Oil Spill Command and Control.

Key Roles	Exercises	Training
OSC PSC LSC EUL	80% of personnel must participate in an IMT exercise annually. Participation in exercises is tracked in the Exercises and Training Schedule and is reviewed monthly or following significant personnel or policy change by the Emergency Response Coordinator.	AMOSC – IMO2 Oil Spill Management.
CMT personnel	Level/Tier 2–3 exercise every 2 years.	Shell-specific – Group Crisis Training.

Table 10-18: Oil Spill Responder Training and Resources

Key Roles	Exercises/Training	Available Resources
Shell AMOSC Core Group Members	AMOSC Core Group Workshop (refresher training every 2 years), Operations stream and management stream.	As defined in AMOSC contractual core group requirements.
AMOSC Core Group Responders	AMOSC Core Group Workshop (refresher training every 2 years).	As defined in AMOSC contractual core group requirements.
OSRL Oil Spill Response Personnel	As per OSRL training and competency matrix.	As defined in OSRL Service Level Agreement.
AMOSC Oil Spill Response Specialists	As per AMOSC training and competency matrix.	As defined in AMOSC Master Services Agreement.
Operational and Scientific Monitoring Service Providers	As defined in the Shell Australia Operational and Scientific Monitoring Bridging Implementation Plan (HSE_PRE_016370).	As per Standby Capability and Competency Report.
Oiled Wildlife Responders (Level 2–4) Shoreline clean-up personnel	As per DBCA OWR requirements (WA ORP Plan). As per WA DoT requirements.	As per OWR state board (AMOSC and DBCA). As defined in AMOSC Master Services and OSRL Service Level Agreements. Team members available through labour hire contracts (training provided prior to deployment).

Shell maintains an Exercise and Training Schedule (as detailed in the Emergency Management Manual [HSE_GEN_010996]) to ensure its competency in responding to and managing major incidents, including oil spills. The Exercise and Training Schedule is reviewed and revised (if required) annually.

As part of this schedule, Shell conducts various exercises, as described in Table 10-19.

Table 10-19: Exercise Types, Objectives and Frequency

Exercise Type	Objective	Frequency
Notification exercise	To test all communication and notification processes to service providers and regulatory agencies defined within the BROPEP.	At least annually. When BROPEP is accepted or introduced. When response arrangements have been significantly amended. If a new location for the activity is added after the response arrangements have been tested.
Equipment deployment exercises	To focus on Shell's deployment capability. To inspect and maintain the condition of Shell's oil spill response equipment.	As per Shell Australia's Exercise and Training Schedule.

Exercise Type	Objective	Frequency
	To maintain training of field response personnel.	
Tabletop exercise	To encourage interactive discussions of a simulated scenario amongst IMT members and refresh roles and responsibilities.	As per Shell Australia's Exercise and Training Schedule.
Incident management exercise	To activate IMT and establish command, control, and coordination of simulated Level/Tier 2 or 3 incident and test response arrangements as described in the BROPEP.	Minimum of one oil spill exercise per year for Shell's activities. If the response arrangements are the same for several activity specific OPEPs, one exercise may be used to test the response arrangements for the OPEPs at the same time. At the discretion of the Well Operations Manager these exercises may be combined in a single event.
National Plan exercises or WA DoT exercises	Participate as required to ensure alignment between National/State Response Framework and Shell's Response Framework.	As determined by AMSA and/or WA DoT, Shell may not be requested to participate every year.
Shell Global Response Support Network (GRSN)	To test the functionality of Shell's Regional Core Group Level/Tier 3 oil spill response capabilities. To achieve a target of 100% for participation of Shell Australia's Core Group personnel in GRSN regional exercises, as required.	Annually. Every 2 years.
AMOSC audit	To test deployment readiness and capability of AMOSC as per its Master Services Agreement with Shell.	Annually.
OSRL audit	To test deployment readiness and capability of OSRL in Singapore as per OSRL's Service Level Agreement with Shell.	Every 2 years.

As part of the exercise process, several documents are prepared to ensure exercises are well planned, conducted and evaluated. These documents are used to support this document preparation:

- Exercise scope document provides background context to the exercise, outlines the exercise need, aim, objectives, details of the scenario, participating groups and agencies, exercise deliverables and management structure. This document can be used to engage a third-party contractor to help conduct the exercise.
- Exercise plan and instructions provides instructions and 'play' (including any injects) for conducting the exercise.
- Post exercise report includes an after-action review of the exercise, evaluating how the exercise performed against meeting its aim and objectives.

10.15.9 Effectiveness of the Response Arrangements

Shell routinely undertakes post-exercise debriefings following Level/Tier 2–3 BROPEP exercises to evaluate the effectiveness of response arrangements against the exercise objectives, identify opportunities for improvement and communicate lessons learned. Shell sets Specific, Measurable, Achievable, Realistic and Timely (SMART) objectives for oil spill exercises so that they can be clearly evaluated as being met or not.

An assessor (internal or external) examines the effectiveness of the response arrangements during a spill exercise. They then make written findings and recommendations to Shell, which Shell uses to help identify deficiencies in the response arrangements and to continually improve their overall response readiness.

Recommendations from the tests will have SMART actions added to them, where appropriate, and these actions will be tracked to closure in Sphera (Shell's action tracking system). The Sphera system assigns a responsible person and due date against each action to ensure they are tracked to closure.

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12 Disclaimer

This document contains data and analysis from Shell's Sky scenario. Unlike Shell's previously published Mountains and Oceans exploratory scenarios, the Sky scenario is based on the assumption that society reaches the Paris Agreement's goal of holding the rise in global average temperatures this century to well below two degrees Celsius (2°C) above pre-industrial levels. Unlike Shell's Mountains and Oceans scenarios, which unfolded in an open-ended way based upon plausible assumptions and quantifications, the Sky scenario was specifically designed to reach the Paris Agreement's goal in a technically possible manner. These scenarios are a part of an ongoing process used in Shell for over 40 years to challenge executives' perspectives on the future business environment. They are designed to stretch management to consider even events that may only be remotely possible. Scenarios, therefore, are not intended to be predictions of likely future events or outcomes.

Additionally, it is important to note that as of 5 January 2021, Shell's operating plans and budgets do not reflect Shell's net-zero emissions ambition. Shell's aim is that, in the future, its operating plans and budgets will change to reflect this movement towards its new net-zero emissions ambition. However, these plans and budgets need to be in step with the movement towards a net-zero emissions economy within society and among Shell's customers.

Also, in this document we may refer to "Shell's Net Carbon Footprint", which includes Shell's carbon emissions from the production of our energy products, our suppliers' carbon emissions in supplying energy for that production and our customers' carbon emissions associated with their use of the energy products we sell. Shell only controls its own emissions but, to support society in achieving the Paris Agreement goals, we aim to help and influence such suppliers and consumers to likewise lower their emissions. The use of the terminology "Shell's Net Carbon Footprint" is for convenience only and not intended to suggest these emissions are those of Shell or its subsidiaries.

The companies in which Royal Dutch Shell plc directly and indirectly owns investments are separate legal entities. In this documentation "Shell", "Shell group" and "Royal Dutch Shell" are sometimes used for convenience where references are made to Royal Dutch Shell plc and its subsidiaries in general. Likewise, the words "we", "us" and "our" are also used to refer to Royal Dutch Shell plc and its subsidiaries in general or to those who work for them. These terms are also used where no useful purpose is served by identifying the particular entity or entities. ''Subsidiaries'', "Shell subsidiaries" and "Shell companies" as used in this document refer to entities over which Royal Dutch Shell plc either directly or indirectly has control. Entities and unincorporated arrangements over which Shell has joint control are generally referred to as "joint ventures" and "joint operations", respectively. Entities over which Shell has significant influence but neither control nor joint control are referred to as "associates". The term "Shell interest" is used for convenience to indicate the direct and/or indirect ownership interest held by Shell in an entity or unincorporated joint arrangement, after exclusion of all third-party interest.

This document contains forward-looking statements (within the meaning of the U.S. Private Securities Litigation Reform Act of 1995) concerning the financial condition, results of operations and businesses of Royal Dutch Shell. All statements other than statements of historical fact are, or may be deemed to be, forward-looking statements. Forward-looking statements are statements of future expectations that are based on management's current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in these statements. Forward-looking statements include, among other things, statements concerning the potential exposure of Royal Dutch Shell to market risks and statements expressing management's expectations, beliefs, estimates, forecasts, projections and assumptions. These forward-looking statements are identified by their use of terms and phrases such as "aim", "ambition', ''anticipate'', ''believe'', ''could'', ''estimate'', ''expect'', ''goals'', ''intend'', ''may'', ''objectives'', ''outlook'', ''plan'', ''probably'', ''project'', ''risks'', "schedule", ''seek'', ''should'', ''target'', ''will'' and similar terms and phrases. There are a number of factors that could affect the future operations of Royal Dutch Shell and could cause those results to differ materially from those expressed in the forward-looking statements included in this document, including (without limitation): (a) price fluctuations in crude oil and natural gas; (b) changes in demand for Shell's products; (c) currency fluctuations; (d) drilling and production results; (e) reserves estimates; (f) loss of market share and industry competition; (g) environmental and physical risks; (h) risks associated with the identification of suitable potential acquisition properties and targets, and successful negotiation and completion of such transactions; (i) the risk of doing business in developing countries and countries subject to international sanctions; (j) legislative, fiscal and regulatory developments including regulatory measures addressing climate change; (k) economic and financial market conditions in various countries and regions; (l) political risks, including the risks of expropriation and renegotiation of the terms of contracts with governmental entities, delays or advancements in the approval of projects and delays in the reimbursement for shared costs; (m) risks associated with the impact of pandemics, such as the COVID-19 (coronavirus) outbreak; and (n) changes in trading conditions. No assurance is provided that future dividend payments will match or exceed previous dividend payments. All forward-looking statements contained in this document are expressly qualified in their entirety by the cautionary statements contained or referred to in this section. Readers should not place undue reliance on forward-looking statements. Additional risk factors that may affect future results are contained in Royal Dutch Shell's Form 20-F for the year ended December 31 2019 (available at www.shell.com/investor and www.sec.gov). These risk factors also expressly qualify all forward-looking statements contained in this document and should be considered by the reader. Each forward-looking statement speaks only as of the date of this document, 5 January 2021. Neither Royal Dutch Shell plc nor any of its subsidiaries undertake any obligation to publicly update or revise any forward-looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward-looking statements contained in this document.

We may have used certain terms, such as resources, in this document that the United States Securities and Exchange Commission (SEC) strictly prohibits us from including in our filings with the SEC. Investors are urged to consider closely the disclosure in our Form 20-F, File No 1-32575, available on the SEC website www.sec.gov.

13 Acronyms

Acronym	Definition
~	Approximately
″	Inch (measurement unit)
<	Less then/fewer than
>	Greater than/more than
≤	Less than or equal to
° C	Degrees Celsius
µg	Micrograms
AAPA	Aboriginal Areas Protection Authority
AAQ	Ambient Air Quality Limits
AAQS	Australian Ambient Air Quality Standards
AARs	After Action Reviews
ABF	Australian Border Force
ABN	Australian Business Number
ACCUs	Australian Carbon Credit Units
ACN	Australian Company Number
ACP	Asset Care Plan
ACR	Acute to Chronic Ratio
ACT	Australian Capital Territory
Activity Area	defined as the production licence AC/L10 and pipeline licences WA-33-PL and AC/PL1.
ADB	Asian Development Bank
ADF	Australian Defence Force
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AGRU	Acid Gas Removal Unit
AHO	Australian Hydrographic Office
AHRC	Australian Human Rights Commission
AHTS	Anchor Handling Tug Supply Vessel
AIMS	Australian Institute of Marine Science
AIPSM	Asset Integrity & Process Safety Management
AIS	Automatic Identification System
ALARP	As low as reasonably practicable
ALRA	*Aboriginal Land Rights (Northern Territory) Act 1976* (Cth)
ALT	Aboriginal Lands Trust

Acronym	Definition
aMDEA	Activated Methyl Diethanolamine
AMMF	Adaptive Monitoring and Management Framework
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian Marine Park
AMS	Asset Management System
AMSA	Australian Maritime Safety Authority
ANZECC	Australian and New Zealand Environment Conservation Council
ANZG	Australian and New Zealand Governments
APPEA	Australian Petroleum Production & Exploration Association Limited
AQP	Air Quality Protection
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ARP	Applied Research Program
ARPA	Automatic Radar Plotting Aid
AS	Australian Standard
ASTM	American Society for Testing and Materials
ASV	Accommodation Support Vessel
AusSAR	Australian Search and Rescue
AUV	Autonomous underwater vehicle
AWSG	Australasian Wader Studies Group
BAC	Balanggarra Aboriginal Corporation
BAT	Best Available Techniques
Bbl	Barrels
BFW	Boiler feed water
BIA	Biologically Important Area
BIAs	Biologically Important Areas
BMP	Biofouling Management Plan
BOD	Biological oxygen demand
BOM	Bureau of Meteorology
BOP	Blowout Preventer
BP	Bollard Pull
BRB	Biofouling Record Book
BROPEP	Browse Regional Oil Pollution Emergency Plan
BSDG	Black Start Diesel Generator
BSL	Below Sea Level

Acronym	Definition
BTEX	Benzene, toluene, ethylbenzene, xylenes
BTU	British Thermal Unit
CA	Conservation Advice
CAMBA	China-Australia Bilateral Agreement on the Protection of Migratory Birds
CCME	Canadian Council of Ministers of the Environment
CCT	Country Coordination Team
CCTV	Closed-Circuit Television
CCWA	Conservation Commission of Western Australia
CD	Closed hydrocarbon Drain
CEO	Chief Executive Officer
CHARM	Chemical Hazard Management Risk Management
CHEMMAP	Chemical Mapping and Analysis Program
CHT	Cylinder head temperature
CIN	CHARM Implementation Network
CITHP	Closed-In Tubing Head Pressure
CITES	Convention on International Trade in Endangered Species
CMMS	Computerised Maintenance Management System
CMST	Centre for Marine Science and Technology
CMT	Crisis Management Team
CO	Carbon monoxide
CO_2	Carbon dioxide
CoA	Commonwealth of Australia
COLREGS	International Regulations for Preventing Collisions at Sea 1972
cP	Centipoise
CR	Corporate Relations (Shell)
CRA	Corrosion Resistant Alloy
CRD	Cryogenic Drain
CSE	Confined Space Entry
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTA	Cable Termination Assembly
Cth	Commonwealth
CW	Cooling Water
DAC	Djarindjin Aboriginal Corporation
DAFF	Commonwealth Department of Agriculture, Fisheries and Forestry

Acronym	Definition
DAM	Discipline Authorities Module
DAWE	Former Commonwealth Department of Agriculture, Water and the Environment (now split into DCCEEW and DAFF)
dB	Decibels
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DC	Drill centre
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DCS	Distributed Control System
DEC	Former Western Australia Department of Environment and Conservation (now DBCA)
DEH	Former Western Australia Department of Environment and Heritage (now DPLH)
DEM	Design and Engineering Management
DEPs	Design and Engineering Practices
DEPWS	Department of Environment, Parks and Water Security
DEWHA	Former Commonwealth Department of Environment Water Heritage and the Arts (now DCCEEW)
DFAT	Commonwealth Department of Foreign Affairs and Trade
DGPS	Differential Global Positioning System
DGV	Default Guideline Values
DISER	Former Commonwealth Department of Industry, Science, Energy and Resources (now DISR)
DISR	Commonwealth Department of Industry, Science, and Resources
DLPE	Department of Lands, Planning and Environment
DMR	Double mixed refrigerant
DMW	De-mineralized water
DNP	Commonwealth Director of National Parks
DO	Dissolved Oxygen
DoE	Former Commonwealth Department of the Environment (now DCCEEW)
DoEE	Former Commonwealth Department of Environment and Energy (now DCCEEW)
DoT	Western Australia Department of Transport
DP	Dynamic positioning
DPAW	Former Department of Parks and Wildlife (now DBCA)
DPIRD	Western Australian Department of Primary Industries and Regional Development
DPLH	Western Australian Department of Planning Lands and Heritage
DSEWPaC	Former Commonwealth Department of Sustainability, Environment, Water, Population and Communities Energy (now DCCEEW)
DTA	Direct Toxicity Assessment
DVA	Direct vertical access

Acronym	Definition
DVC	Digital Valve Controller
DWER	Western Australian Department of Water and Environmental Regulation
E	East (compass direction)
EAAF	East Asian-Australasian Flyway
ECE	Environmental Critical Element
ECU	Electrochlorination Unit
EDG	Emergency Diesel Generators
EEZ	Exclusive economic zone
EGCS	Exhaust Gas Cleaning System
EGR	External and Government Relations
EHS	Environmental Health Safety
EIAPP	Engine International Air Pollution Prevention (certificate)
EIS	Environmental Impact Statement
EMBA	Environment that May Be Affected
EMG	Emergency Diesel Generators
ENC	Environmental Non-Compliance
ENE	East-north-east (compass direction)
ENVID	Environmental Risk Identification
EP	Environment Plan
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ER	Emergency Response
ER_{95}	95th Percentile Exposure Ranges
ERM	Environmental Resources Management (company)
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESD	Ecologically Sustainable Development
ESHIA	Environmental, Social and Health Impact Assessment
ETS	Energy Transition Strategy
EUL	Environment Unit Lead
eWIMS	Wells Integrity Management System
FCA	Federal Court of Australia

Acronym	Definition
FCRBV	Fail-Closed Riser Base Valves
FDH	Cold Dry High-Pressure Flare
FDL	Cold Dry Low-Pressure Flare
FFG	Flame front generator
FGS	Fire and Gas System
FID	Final Investment Decision
FIM	Fountain Incident Management
FLBM	Frontline Barrier Management
FLNG	Floating Liquefied Natural Gas
FME	Full moon equivalents
FO	Fibre optic
FOB	Forward Operations Base
FPSO	Floating Production Storage and Offloading (facility)
FRC	Fast rescue craft
FRDC	Fisheries Research and Development Corporation
FSR	Facility Status Report
FWAD	Fixed Wing Aerial Dispersant
FWD	Forward
FWH	Warm Wet High-Pressure Flare
FWL	Warm Wet Low-Pressure Flare
GFA	Global Framework Agreement
GFMR	Global Flaring and Methane Reduction
GHG	Greenhouse gas
GHGEM	Greenhouse Gas and Energy Management
GHGEMP	Greenhouse Gas and Energy Management Plan
GHGEMS	Greenhouse Gas and Energy Management System
GIS	Geographic Information System
GLC	Ground Level Concentration
GMAS	Group Maritime Assurance System
GRSN	Global Response Support Network (Shell)
GTG	Gas Turbine Generator
HAZID	Hazard Identification
HAZOP	Hazard and Operability
HEMP	Hazards and Effects Management Process

Acronym	Definition
HF	High Frequency
HFO	Heavy Fuel Oil
HLIV	Heavy Lift Installation Vessel
HMA	Hazard Management Agency
HMI	Human Machine Interface
HOCNF	Harmonized Offshore Chemical Notification Format
HP	High Pressure
HPLT	High Pressure Leak Testing
hr	Hour
HSE	Health, Safety and Environment
HSSE and SP	Health, Security, Safety, Environment and Social Performance
HVAC	Heating, Ventilation and Air Conditioning
Hz	Hertz
i.e.	That is
IAP	Incident Action Plan
IAPP	International Air Pollution Prevention (Certificate)
IBC	Intermediate Bulk Container
ICS	Incident Command System
ICSS	Integrated Control and Safeguarding System
ID	Internal diameter
IEA	International Energy Agency
IEE	International Energy Efficiency (Certificate)
IFC	International Finance Corporation
IFO	Intermediate Fuel Oil
IGF	Induced Gas Floatation
ILSC	Indigenous Land and Sea Corporation
ILUA	Indigenous Land Use Agreement
ILUAs	Indigenous Land Use Agreements
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMEA	Infection Modes and Effects Analysis
IMO	International Maritime Organization
IMR	Inspection, Maintenance and Repair
IMS	Invasive Marine Species
IMSA	Integrity Management System Application

Acronym	Definition
IMT	Incident Management Team
IMT (W)	Incident Management Team West
IMT(W)	Incident Management Team (West)
IOGP	International Association of Oil and Gas Producers
IOPP	International Oil Pollution Prevention
IPAs	Indigenous Protected Areas
IPCC	Intergovernmental Panel on Climate Change
IPEICA	The International Petroleum Industry Environmental Conservation Association
IPS	Instrumented Protective System
ISO	International Organization for Standardisation
ISPP	International Sewage Pollution Prevention
ISVs	Infield Support Vessels
ITF	Indonesian Throughflow
IUCN	International Union for the Conservation of Nature
JAMBA	Japan-Australia Bilateral Agreement on the Protection of Migratory Birds
JASMINE	JASCO Animal Simulation Model Including Noise Exposure
JMPs	Joint Management Plans
JRCC	Joint Rescue Coordination Centre
KEF	Key Ecological Features
KISSP	Kimberley Indigenous Saltwater Science Project
KLC	Kimberley Land Council
KPI	Key Performance Indicator
kW	Kilowatt
L	Litre
LAFD	Latest Allowable Finish Date
LAT	Lowest Astronomical Tide
LDAR	Leak Detection and Repair
LF	Low Frequency
LNG	Liquefied Natural Gas
LOC	Loss of containment
LOD	Line of Defense
LOPC	Loss of Primary Containment
LOR	Levels of reporting
LOTO	Lock-Out Tag-Out

Acronym	Definition
LOWC	Loss of well containment
LP	Low Pressure
LPG	Liquefied Petroleum Gas
LQ	Living quarters
LRV	Low Reliability Value
LSC	Logistic Section Chief
LSMGO	Low Sulphur Marine Gas Oil
LWI	Light Well Intervention
m, m^2, m^3	Metre, square metre, cubic metre
MAC	Managed Asset Care
MAE	Major Accident Events
MAH	Monocyclic Aromatic Hydrocarbons
MARPOL	The International Convention for the Prevention of Pollution from Ships, adopted by the International Conference on Marine Pollution, convened by IMO, 1973/78.
MARS	Maritime Arrivals Reporting System
MBC	Maritime Border Command
MBES	Multibeam Echo Sounder
MBP	Mixed bed polisher
MC	Measurement criteria
MCHE	Main cryogenic heat exchanger
MCR	Maximum Continuous Rating
MD	Measured Depth
MDEA	Methyldiethanolamine
MDO	Marine Diesel Oil
MEE	Major Environmental Event
MEECC	Western Australian Maritime Environmental Emergency Coordination Centre
MEG	Mono-ethylene Glycol
MFO	Marine fauna observer
MG	Milligram
MGC	Marine growth covers
MGO	Marine Gas Oil
MHWS	Mean High Water Spring
MIP	Methane Improvement Plan
MLWS	Mean Low Water Spring

Acronym	Definition
mm	Millimetre
MMPATF	Marine Mammal Protected Areas Task Force
MNES	Matters of National Environmental Significance
MNP	Marine National Park
MoC	Management of Change
MODU	Mobile Offshore Drilling Unit
MOPO	Manual Of Permitted Operations
MOU	Memorandum of Understanding
MP	Management Plan
MPPE	Macro Porous Polymer Extraction
MPSV	Multipurpose Platform Supply Vessels
MPV	Multi-Purpose Vessel
MR	Mixed refrigerant
MRU	Mercury Removal Unit
MS	Management System
MSC	Maximum production capacity
MSL	Mean Sea Level
MTAC	Maintenance, Turnaround & Construction
MTO	Manage Threats and Opportunity
MW	Mega watt
MWS	Marine Warranty Surveyor
N	North (compass direction)
N_2	Nitrogen gas
N_2O	Nitrous oxide
NATA	National Association of Testing Authorities
NCBI	National Centre for Biotechnology Information
NCC	Normally Clean Condensate
NDC	Nationally Determined Contribution
NE	North-east (compass direction)
NEPM	National Environment Protection Measures
NERA	National Energy Resources Australia
NFA	No Further Activity
NFR	Near-Field Region
NGER	National Greenhouse and Energy Reporting

Acronym	Definition
NGL	Natural Gas Liquid
NGO	Non-Government Organisations
NHP	National Heritage Places
NIAA	National Indigenous Australians Agency
NLC	Northern Land Council
nm	Nautical Mile
NMFS	National Marine Fisheries Service
NMR	North Marine Region
NNE	North-north-east (compass direction)
NNTT	National Native Title Tribunal
NNW	North-north-west (compass direction)
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOEC	No Observed Effect Concentration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NORM	Naturally Occurring Radioactive Materials
NO_x	Nitrogen oxides, typically expressed as NO_2
NPI	National Pollutant Inventory
NPSH	Net Positive Suction Head
NRC	National Research Council
NRETAS	Former Northern Territory Department of Natural Resources, Environment, the Arts and Sport (now Department of Lands, Planning and Environment)
NSW	New South Wales
NT	Northern Territory
NTA	*Native Title Act 1993 (Cth)*
NTOWRP	NT Oiled Wildlife Response Plan
NTRB	Native Title Representative Bodies
NW	North-west (compass direction)
NWCS	North-West Cable System
NWMR	North West Marine Region
NWS	North West Shelf
NZS	New Zealand Standard

Acronym	Definition
OBD	Open Bilge Drain
OCD	Open Chemical Drain System
OCIMF	Oil Companies International Marine Forum
OCNS	Offshore Chemicals Notification Scheme
OD	Open Non-Hazardous Drain System
ODME	Oil Discharge Monitoring Equipment
ODS	Ozone Depleting Substances
OFOV	Orientation field of view
OGMP	Oil & Gas Methane Partnership
OGP	Oil and Gas Producers
OHD	Open Hazardous Drain System
OHS	Occupational Health and Safety
OIE	Offset Installation Equipment
OIM	Offshore Installation Manager
OIW	Oil-in-water
OMP	Operational Monitoring Plan
OP	Operating Plan
OPEP	Oil Pollution Emergency Plan
OPGGS (E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPP	Offshore Project Proposal
OPRC 90	International Convention on Oil Pollution Preparedness, Response and Cooperation 1990
OSC	Operations Section Chief
OSD	Open Steam Condensate Drain System
OSMP	Operational and Scientific Monitoring Plan
OSPAR	Oslo and Paris Conventions for the protection of the marine environment of the North-East Atlantic
OSRL	Oil Spill Response Limited
OVID	Offshore Vessel Inspection Database (owned by Oil Companies International Marine Forum)
OWR	Oiled Wildlife Response
PAGA	Public Address/General Alarm
PAH	Polycyclic Aromatic Hydrocarbon
PBC	Prescribed Bodies Corporate
PCH	Potentially Contaminated Condensate with Heavy Hydrocarbons

Acronym	Definition
PCL	Potentially Contaminated Condensate with Light Hydrocarbons
PEFS	Process Engineering Flow Schemes
PFAS	Per- and polyfluoroalkyl substances
PFS	Process Flow Schemes
PFW	Produced Formation Water
pH	Measure of acidity or basicity of a solution
PIC	Person in Charge
PK	Peak (sound pressure level)
PLET	Pipeline End Termination
PLONOR	Poses Little or No Risk
PM	Particulate matter
$PM_{2.5}$, PM_{10} etc.	Particulate matter with a diameter of 2.5/10 micrometres or less
PMCT	Prelude Modifications for Crux Tie-In
PME	Perform Maintenance Execution
PML	Preventative Maintenance Library
PMR	Pre-cool mixed refrigerant
PMST	Protected Matters Search Tool (EPBC Act)
PNEC	Predicted no effect concentration
POB	Persons on Board
POLREP	Pollution Report
POP	Persistent Organic Pollutant
PPM	Parts per million
PPT	Parts per trillion
PSBR	Process Safety Basic Requirements
PSC	Planning Section Chief
PSU	Practical Salinity Units
PSV	Platform Supply Vessel
PSZ	Petroleum Safety Zone
PTM	Proactive technical monitoring
PTS	Permanent threshold shift
PTW	Permit to work
PW	Produced Water
PWSNT	Parks and Wildlife Service Northern Territory
Qld	Queensland

Acronym	Definition
QPA	Quarterly Performance Appraisal
RA	Risk Assessment
RAM	Risk Assessment Matrix
RBI	Risk Based Inspection
RBM	Riser Base Manifold
RCC	Rescue Coordination Centre
RCM	Reliability Centred Maintenance
RESDV	Riser Emergency Shutdown Valve
RFSU	Ready for Start-Up
RIH	Run in hole
RNTBC	Registered Native Title Bodies Corporate
RO	Reverse Osmosis
ROKAMBA	The Republic of Korea Migratory Birds Agreement
ROV	Remotely Operated Vehicle
RP	Recovery Plan
RPAS	Remotely Piloted Aircraft System
RVGMS	Riser Vent Gas Monitoring System
RWIS	Relief well injection spool
SAFS	Status of Australian Fish Stocks
SAI	Shell Aircraft International
SAMP	Strategic Asset Management Plan
SAP	Systems, Applications, and Products (Enterprise Resource Planning software)
SCAT	Shoreline clean up assessment technique
SCE	Safety Critical Elements
SCM	Subsea control module
SCSSV	Surface Controlled Sub-Surface Safety Valve
SE	South-east (compass direction)
SEAM	Safety, Environment & Asset Management
SEEMP	Ship Energy Efficiency Management Plan
SEL	Sound Exposure Level
SFRT	Subsea First Response Toolkit
SG	Specific gravity
SGG	Synthetic greenhouse gases
SGRAO	Shell Group Requirements for Aircraft Operations

Acronym	Definition
Shell	Shell Australia Pty Ltd
SID	Subsea Intervention Device
SIMA	Spill impact mitigation assessment
SIMOPs	Simultaneous Operations
SIRT	Subsea Incident Response Toolkit
SITREP	Situation Report
SMART	Specific, Measurable, Achievable, Realistic and Timely
SMC	Safeguard Mechanism Credits
SME	Subject Matter Expert
SMEEC	State Maritime Environmental Emergency Coordinator (WA)
SMV	Surveillance, modelling and visualisation
SO_2	Sulphur dioxide
SOF	Statement of Fitness
SOLAS	International Convention for the Safety of Life at Sea 1974
SOPEP	Shipboard Oil Pollution Emergency Plan
SP	Social Performance
SPDC	Shell Petroleum Development Company of Nigeria Limited
SPF	Shell Performance Framework
SPFP	Site Process Focal Point(s)
SPL	Sound Pressure Level
SPO	Site Process Owner
SSC	Species Survival Commission
SSD	Species Sensitivity Distribution
SSDI	Subsea dispersant injection
SSIV	Subsea Isolation Valve
SSS	Side-scan Sonar
STCW Convention	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978
STG	Steam Turbine Generators
SURU	Start-up Ramp-up
SW	South-west (compass direction)
TA	Maintenance Turnaround
TACL	Threshold Activity Concentration Limits
TAP	Threat Abatement Plan
TEC	Threatened Ecological Communities

Acronym	Definition
TEG	Triethylene glycol
TEMC	Territory Emergency Management Council
TKN	Total Kjeldahl Nitrogen
TLC	Tiwi Land Council
TMS	Turret Mooring System
TN	Total Nitrogen
TOC	Total Organic Carbon
TP	Total Phosphorus
t/hr	Tonnes per hour
t/pa	Tonnes per annum
t/pd	Tonnes per day
TPH	Total Petroleum Hydrocarbons
TRH	Total hydrocarbon
TRP	Tactical Response Plan
TSS	Total Suspended Solids
TSSC	Threatened Species Scientific Committee
TTS	Temporary Threshold Shift
TVD	True Vertical Depth
UCH Act	Commonwealth *Underwater Cultural Heritage Act 2018*
UHF	Ultra-high frequency
UK	United Kingdom
UN	United Nations
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UPS	Uninterruptable power supply
US/USA	United States/United Sates of America
USEPA	United Stated Environmental Protection Agency
UTA	Umbilical termination assemblies
UV	Ultraviolet
UWILD	Underwater Inspection In Lieu of Drydocking
UXO	Unexploded Ordnance
VHF	Very high-frequency

Acronym	Definition
VOC	Volatile Organic Compounds
VSAT	Very small aperture terminal
VSD	Variable Speed Drivers
VT	Variable Table
W	West (compass direction)
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WAM	Western Australia Museum
WAOWRP	WA Oiled Wildlife Response Plan
WB	World Bank
WCVERT	Well Control Virtual Emergency Response Team
WET	Whole Effluent Toxicity
WGAC	Wunambal Gaambera Aboriginal Corporation
WHA	World Heritage Area
WHO	World Health Organization
WHRU	Waste heat recovery units
WMS	Weather Monitoring System
WOMP	Well Operations Management Plan
WRFM	Well, Reservoir and Facility Management (WRFM)
WSW	West-south-west (compass point)
WWF	World Wildlife Fund
XT	Xmas tree for wellheads
ZPI	Zone of potential impact

Appendix A Consultation Engagement Materials

Please open this file using Adobe Acrobat (rather than a browser) to ensure the embedded media files will play.

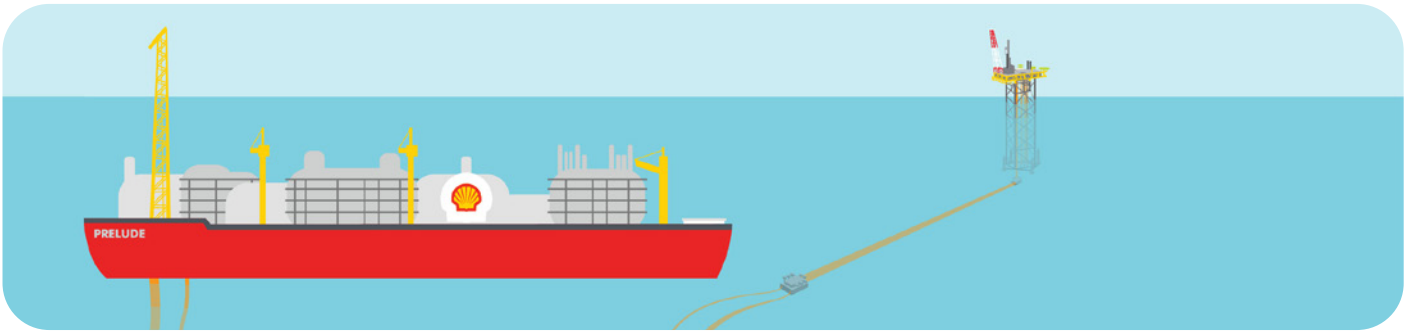
Appendix A - Consultation Material – Table of Contents

Content	
1. Information Sheets	1.00 Prelude FLNG Five Yearly Revision Environment Plan Information Sheet 1.01 General Environment Plan Information Sheet
2. Maps	2.00 Prelude FLNG Planning Area Map
3. Advertising campaign	3.00 Prelude advertising campaign – proof of placement **Print advertising** 3.01 Broome Advertiser and Kimberley Echo 3.02 National Indigenous Times and Koori Mail 3.03 Northern Territory News 3.04 The West Australian **Digital** 3.05 Facebook video 1 3.06 Facebook video 2 3.07 Facebook video 3 3.08 Linkedin video 1 3.09 Linkedin video 2 3.10 Linkedin video 3 **Radio** 3.11 Radio – ARN 3.12 Radio – First Nations and Goolarri 3.13 Radio – SCA 3.14 Radio Script
4. Community session promotion	4.00 Drop-in session promotion – Broome and Derby 4.01 Drop-in session promotion – Darwin 4.02 Drop-in session promotion – Djarindjin 4.03 Drop-in session promotion – Wyndham and Kununurra 4.04 Community information session promotion – Broome 4.05 Community information session promotion – Darwin
5.5. Community / Industry Presentation	5.00 Community Information Session - Broome 5.01 Community Information Session - Darwin
6 Animation	6.00 Prelude Animation 6.01 Prelude Animation Transcript
7 Indigenous presentation	7.00 Standard presentation template
8. NOPSEMA	8.00 NOPSEMA Consultation on Offshore Petroleum Environment Plan Brochure

All template emails sent to relevant persons can be found in the sensitive information report.

Information Sheet

Prelude Floating Liquefied Natural Gas Facility Environmental Plan Revision



Shell Australia is seeking to consult with people in preparation of the five-yearly revision of the Prelude Floating Liquefied Natural Gas Facility (Prelude) Environment Plan.

We want to hear from you if your functions, interests, or activities, may be affected by the activities, risks and impacts described in the Environment Plan information sheet, or if you have cultural heritage interests, or if you know someone else who may be affected.

About Prelude

Prelude is a floating liquefied natural gas (FLNG) facility moored offshore approximately 475 kilometers north-northeast of Broome in Western Australia. Prelude extracts, liquefies, and stores LNG, LPG and condensate at sea, before it is exported to customers around the globe.

Prelude is connected to the gas reservoir and wells via flexible risers routed to the turret. The facility is a permanently manned facility. Periodic major maintenance or turnarounds are carried out in-field during the operate phase. Prelude will also receive and process gas from Crux once operating. For more information on Crux, visit www.shell.com.au/crux.

Shell Australia is the operator in joint venture with INPEX, KOGAS and OPIC.

EP feedback

Information received will be documented in the Environment Plan (EP) revision, when submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), for assessment. Once accepted, the EP will be published online. You may request that sensitive information you provide is not published.

Shell Australia respectfully acknowledges the many Traditional Owner groups of the lands and waters on which we operate and pay our respect to Elders past, and present, and emerging.

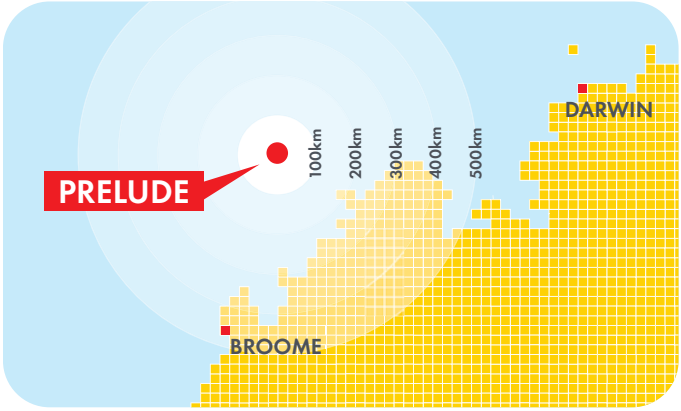
Location:
Browse Basin, 200 kilometers offshore north-west Australia and 475km north-northeast of Broome.

Offshore Petroleum Titles:
In Commonwealth Waters and the Territory of Ashmore and Cartier Islands. Petroleum permit areas WA-44-L and WA-2-IL.

Water depth:
250 metre

Designed production rates:
3.6 million tonnes per annum (mtpa) LNG, 0.4 mtpa LPG, 1.3 mtpa condensate

Status:
In operation



Contact Us Community Hotline: 1800 059 152 Email: SDA-preludeflng@shell.com

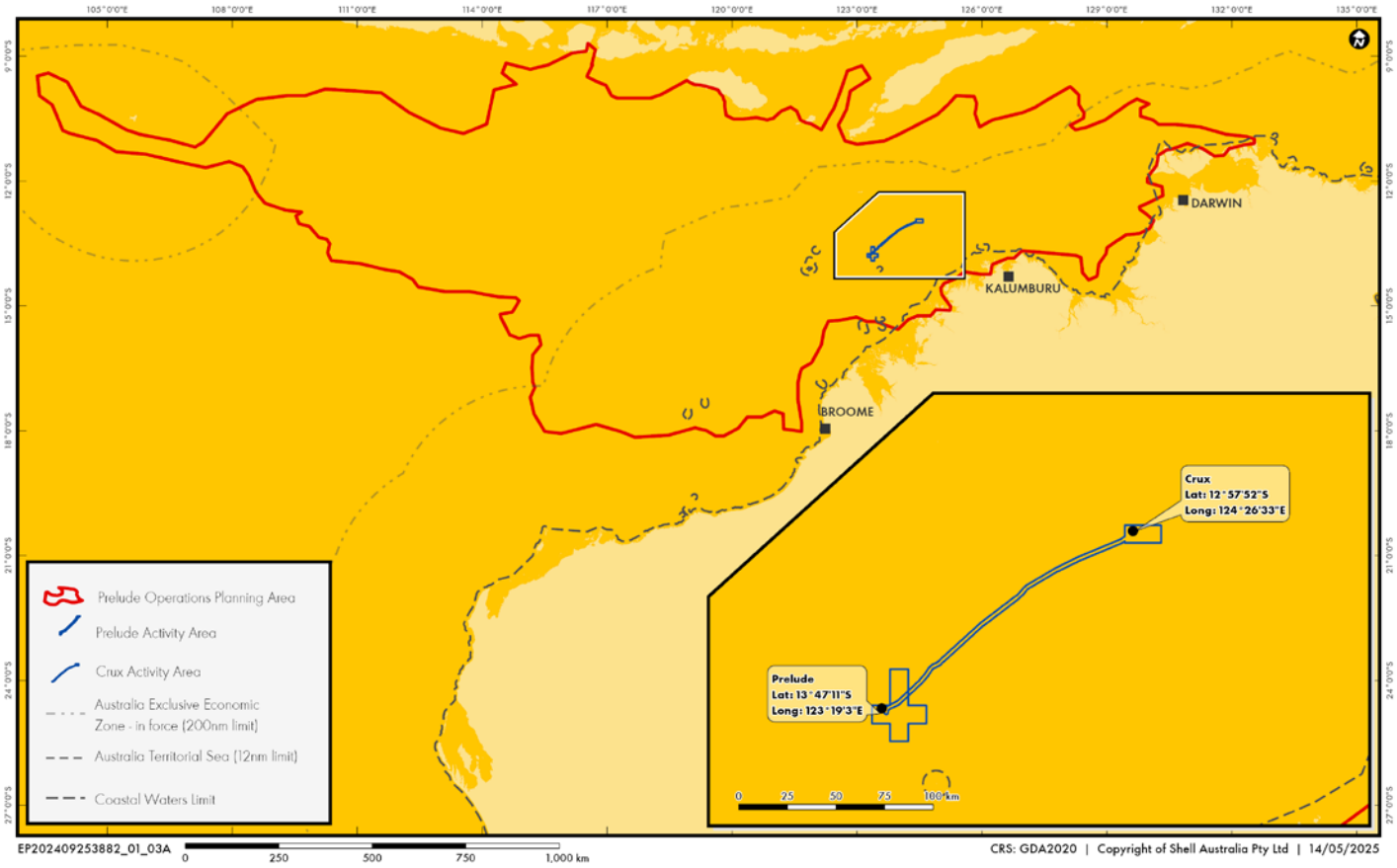


Figure 1: Reflects revised spill modelling May 2025

The planning area

The planning area is the largest area where Prelude activity could have a direct or indirect environmental or socio-economic impact.

The planning area represents the total area that a spill could travel along many possible pathways depending on surface conditions, currents, and weather at the time of an incident. These combined pathways are developed using sophisticated spill modelling, and the planning area boundary captures the greatest extent of the hundreds of potential release pathways produced by the modelling software.

In the highly unlikely event of one of these scenarios occurring, only a small part of this planning area would be impacted. Understanding the greatest extent of a release ensures Shell Australia has appropriate response plans in place.

Shell continues to undertake modelling work to understand potential impacts related to this EP.

Notification to mariners

A 500-metre Petroleum Safety Zone has been established under the Offshore Petroleum and Greenhouse Gas Storage Act (2006) and administered by NOPSEMA around the Prelude facility. This Zone is marked on all relevant marine navigation charts issued through the Australian Hydrographic Office. A notice to mariners will be issued via the Australian Hydrographic Office in advance of any activities, detailing the Petroleum Safety Zone and associated restrictions of entry.

Environmental approvals

Before Shell Australia commences substantial work on major projects or existing facilities, regulatory, environmental, and social impacts are assessed, alongside commercial and technical considerations.

The purpose of this consultation is to give you an opportunity to provide input into:

- Shell Australia's understanding of the existing environment which may be affected by activities within this EP, including the cultural features of that environment.
- how Shell Australia's activities might impact the existing environment (including its cultural features); and
- how controls and mitigation measures may be adopted by Shell Australia, to reduce the environmental impact associated with the proposed activities.
- current Prelude Environment Plan was accepted by NOPSEMA in January 2021and is publicly available on the NOPSEMA website.

This Prelude Environment Plan is the five-yearly revision as required in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023).

Activity description

- **Production operations:** including receiving and processing Crux gas and maintenance turnarounds of Prelude and its subsea facilities.
- **Operations within the designated safety zone:** including supply and in-field support vessels and helicopters. Product offtake tankers or bunkering vessels only when they are attached to Prelude (considered a petroleum activity)
- **Maintenance and inspection:** including activities to inspect and maintain hardware and equipment and underwater inspection, maintenance and repair of subsea facilities, systems and infrastructure
- **Physical modifications to the facility:** including removal, re-purposing, and installation of equipment, to facilitate its operational life in line with design intent and to maintain safe and reliable operations.
- **Well intervention activities:** using a light well intervention vessel.
- **Services:** including:
  - Maritime and terminal Operations - activities relating to the management of access and movement of marine vessels within the Safety Zone; and the management of product offloading and import activities.
  - Helicopter operations.
  - Management of lifting and hoisting and deck services on Prelude.
  - Facility catering services.
- Potential future tie-ins.
- Emergency Response events.

Environmental Management

Aspect	Control
Physical presence, vessel movements and seabed disturbance	• Australian Hydrographic Office Notice to Mariners. • 500m Petroleum Safety Zone implemented. • All vessels operating within the activity area will adhere to navigation safety requirements within the International Regulations for Preventing Collisions at Sea 1972 (COLREGS), Chapter 5 of The International Convention for the Safety of Life at Sea 1974 (SOLAS Convention), International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention), the Navigation Act 2012 and any subsequent Marine Orders, which specify standards for crew training and competency, navigation, communication, and safety measures. • Vessels will adhere to the requirements of the EPBC Regulations Part 8.1 – Interacting with cetaceans, (except in emergency conditions or when maneuvering is not possible). • Vessels used for Inspection, Maintenance and Repair will not anchor under routine operations.
Noise	• EPBC Regulations Part 8.1 – Interacting with cetaceans.
Light	• Lighting limited to the minimum required for navigational and safety requirements, except for emergency events. • Lighting on Prelude is designed to minimise light spill.

Liquid discharges	• Prior to discharge, produced water is treated to reduce dispersed oil.
	• Oil-in-water concentrations will be monitored by an online analyser and the discharge rate will be measured using a flow meter.
	• The discharge limit for dispersed oil will be a 24-hour average of 30 mg/L and an instantaneous limit of 42 mg/L. Should this limit be exceeded, the water will be manually diverted inboard for reprocessing. Exceptions for well clean-up activities are planned to be allowed for, not exceeding an instantaneous discharge limit of 100 mg/l.
	• Produced water sample testing includes:
	  ◦ chemical characterisation.
	  ◦ whole effluent ecotoxicological testing.
	• Adaptive management is in place should results from the monitoring program meet thresholds for further action.
	• Deck drainage and bilge on Prelude will be treated through a MARPOL compliant oil water separator before discharge overboard.
	• Offshore discharge of sewage from Prelude and support vessels will be in accordance with Marine Order 96.
	• Prelude and associated vessel food wastes will be macerated to < 25 mm particle size prior to discharge to sea, in accordance with Marine Order 95.
	• Where there is the potential for loss of primary containment of oil and chemicals on Prelude or vessels, bunding or drainage systems are in place to contain spills.
	• All planned discharges from support vessels will comply with relevant requirements of MARPOL 73/78, the Navigation Act 2012, Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and any subsequent Marine Orders requirements.

Environmental Management (continued)

Aspect	Control
Chemical discharges	• Shell Australia's Chemical Management Process will be used to ensure the level of impact is acceptable and (ALARP).
Atmospheric emissions	• Prelude is designed to be an inherently minor source of atmospheric emissions. • Vessels comply with relevant requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL) and associated regulations. • Relevant vessels will have a valid International Air Pollution Prevention Certificate. • Use of low sulphur fuel.
Greenhouse gas emissions	• Comply with the National Greenhouse and Energy Reporting Act (2007) and National Greenhouse and Energy Reporting Regulations (2008). • Comply with Safeguard Mechanism requirements as they apply to Prelude. • Comply with MARPOL requirements and associated regulations. • Greenhouse gas and energy management plan implemented to reduce emissions to ALARP and acceptable levels. This includes monitoring of all GHG emissions sources and an annual review of measures to further reduce GHG emissions to ALARP. • Maintain flare to maximise efficiency of combustion.
Waste management	• Comply with regulatory requirements for the prevention of marine pollution and handling of hazardous wastes. • Waste management procedure implemented that provides for: ◦ Waste segregation. ◦ Safe handling and transportation. ◦ Appropriate waste classification. ◦ Disposal, and recycling at licensed waste facilities. • Discharge of waste from vessels will comply with relevant MARPOL requirements and associated regulations.
Emergency events	• Environment Plan and Oil Pollution Emergency Plan in place. • Operational and Scientific Monitoring Plan. • Maintenance management system. • Simultaneous operations management plans where required. • Safety Case in place. • Shell Australia Source Control Emergency Response Plan. • Align with relevant International Convention for the Prevention of Pollution from Ships requirements and subsequent regulations. • Valid Shipboard Oil Pollution Emergency Plan or Shipboard Marine Pollution Emergency Plan (as appropriate for vessel classification). • Spill kits positioned around Prelude and vessels (near potential spill points such as transfer stations). • Implementation of national and international regulations and conventions for collision prevention, safety, and navigation at sea.
Introduction of invasive marine species from vessels	• Ballast water exchange operations will comply with the international conventions and associated national regulations. • Biofouling management for vessels in accordance with state, national and international biofouling management requirements. • Biofouling management in compliance with state and commonwealth regulations. • Vessels (of appropriate class) will have a valid International Anti-Fouling System Certificate.

Contact Us

Community Hotline: 1800 059 152
Email: SDA-preludeflng@shell.com

www.shell.com.au/prelude

Shell Australia welcomes any feedback on Environment Plan submissions, including requests for further information.

If you have functions, interests or activities that may be affected, or you know someone who might have, Shell Australia invites you to get in touch.

For further information about our consultation obligations under the Offshore Petroleum and Greenhouse Gas (Environment) Regulations 2023, visit www.nopsema.gov.au

ENVIRONMENT PLAN GENERAL INFORMATION SHEET

We want to hear from you if your functions, interests, or activities, may be affected by the activities, risks and impacts described in this Environment Plan, or if you have cultural heritage interests, or if you know someone else who may be affected.

SHELL AUSTRALIA

Shell has operated in Australia for over 120 years. From operating Australia's first oil refinery, which was central to meeting Australia's fuel needs, to fuelling the first Qantas commercial flight in the 1920s, to playing a foundation role in building some of Australia's largest and most innovative natural resource developments - as the energy needs of Australia have changed, so have we.

Today, we are a leading natural gas producer and are playing our part in the transition to a low-carbon future by investing in the power sector, renewable energy solutions and carbon abatement activities

WHAT IS CONSULTATION?

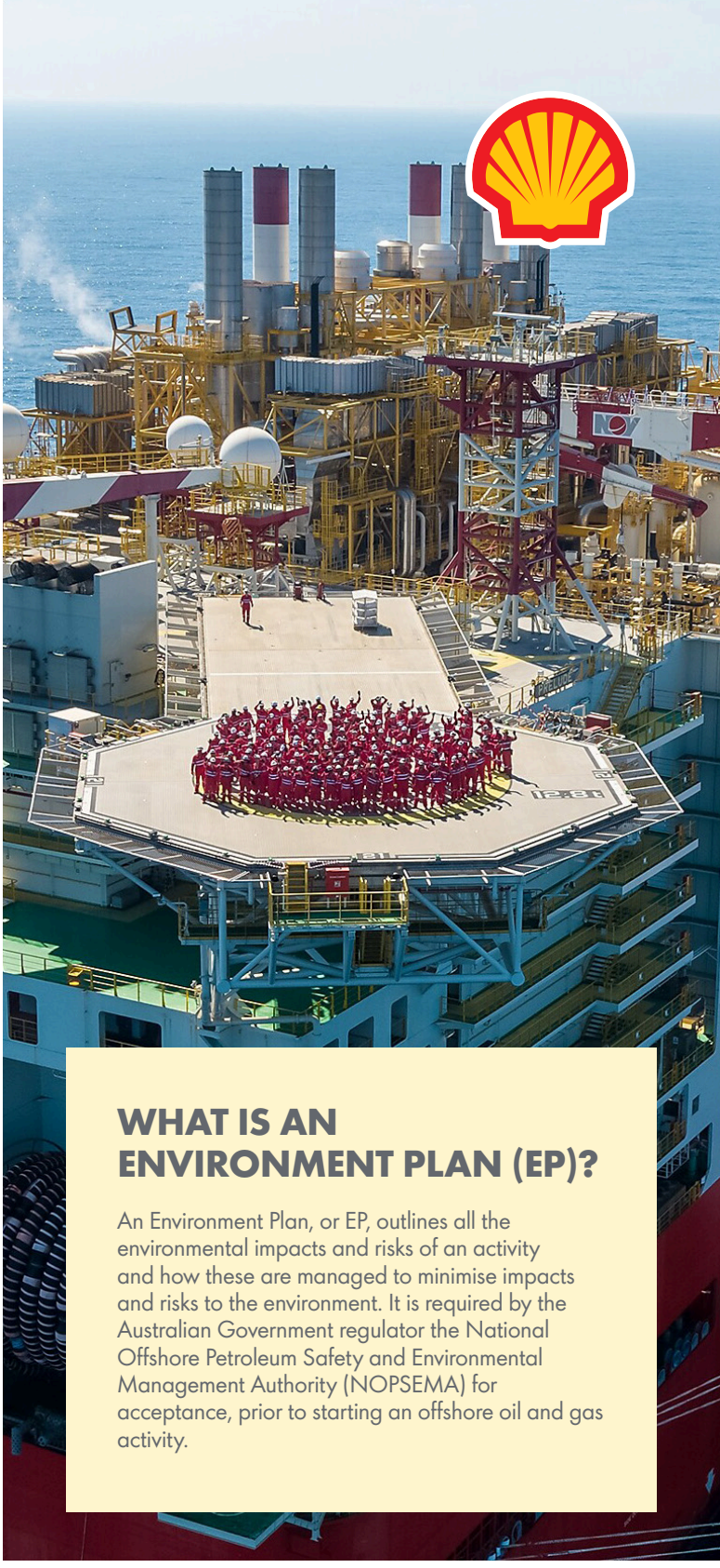
Guidelines for consultation are outlined in the Offshore Petroleum and Greenhouse Gas Storage Environment Regulation 25.

The purpose of consultation is to give relevant persons an opportunity to provide input into:

- Shell's understanding of the existing environment which may be affected by proposed activities, including the cultural features of that environment;
- how Shell's activities might impact the existing environment (including its cultural features); and
- how controls and mitigation measures may be adopted to protect what is important to you.

Consultation is designed to ensure that relevant persons are identified and given sufficient information and a reasonable period to allow them to make an informed assessment of the possible consequences of the proposed activity on them. It is also intended to help inform a better understanding of the environment.

Shell Australia must consider and adopt appropriate measures in response to the matters raised by relevant persons. These actions will in turn inform the management of environmental impacts and risks to which the activity and EP relate.



WHAT IS AN ENVIRONMENT PLAN (EP)?

An Environment Plan, or EP, outlines all the environmental impacts and risks of an activity and how these are managed to minimise impacts and risks to the environment. It is required by the Australian Government regulator the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance, prior to starting an offshore oil and gas activity.

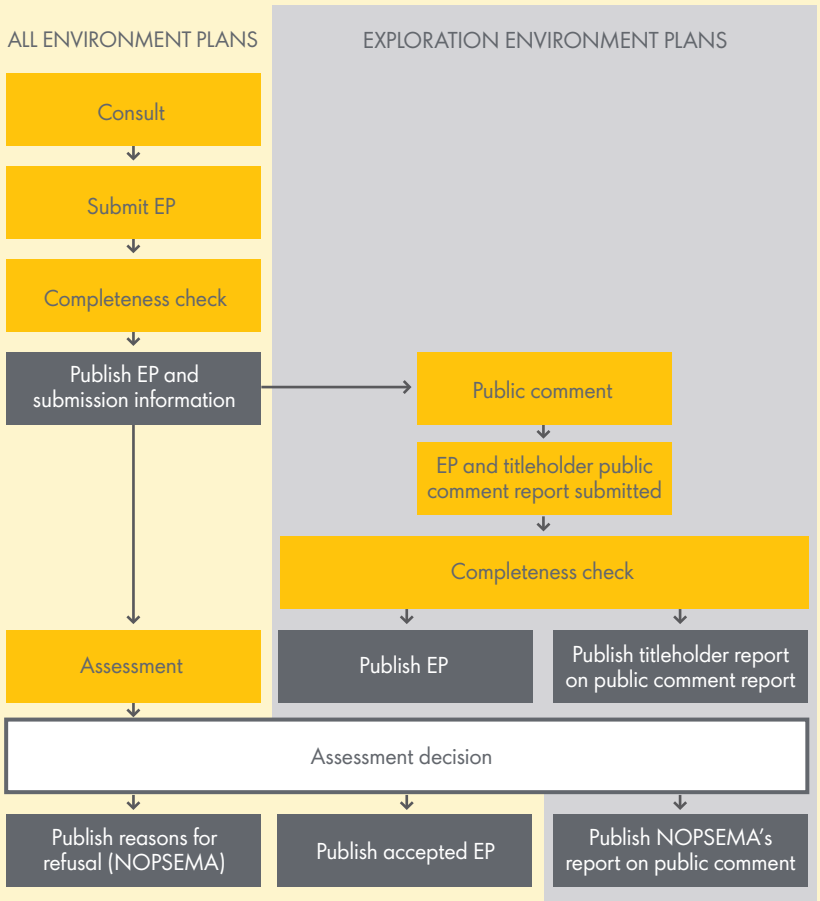
National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)

The National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) is Australia's independent expert regulator for health and safety, structural (well) integrity and environmental management for all offshore energy operations and greenhouse gas storage activities in Commonwealth waters, and in coastal waters where regulatory powers and functions have been conferred.

CONTACT US Community Hotline: 1800 059 152 Email: SDA-crux-project@shell.com www.shell.com.au/crux

Shell Australia welcomes any feedback on Environment Plan submissions, including requests for further information.
If you have functions, interests or activities that may be affected, or you know someone else who might have, Shell Australia invites you to get in touch. For further information about our consultation obligations under the Offshore Petroleum and Greenhouse Gas Storage Act 2006, visit www.nopsema.gov.au

NOPSEMA'S ASSESSMENT PROCESS FOR EPS



FEEDBACK

At Shell, we recognise the environmental, heritage, social, cultural, and economic values of the region. Shell has undertaken extensive surveys, studies, and a comprehensive review of available information in order to understand and detail the sensitivities and values within the region.

We welcome and seek feedback from relevant persons on our understanding of these values. We are committed to working with relevant persons as part of our ongoing efforts to engage and improve our understanding of the sensitivities and values of the region. Additionally, values and sensitivities are assessed during the risk and impact assessments for any project. Shell will demonstrate how those impacts and risks will be reduced to a level that is as low as reasonably practicable through additional control measures and/or project modifications.

Shell welcomes any feedback, including requests to receive further information. If you have functions, interests or activities that may be affected by any of our projects, Shell Australia invites you to get in touch.

Any information received during EP consultation must be documented in the EP when submitted to NOPSEMA for assessment. Following acceptance, the EP will be published online.

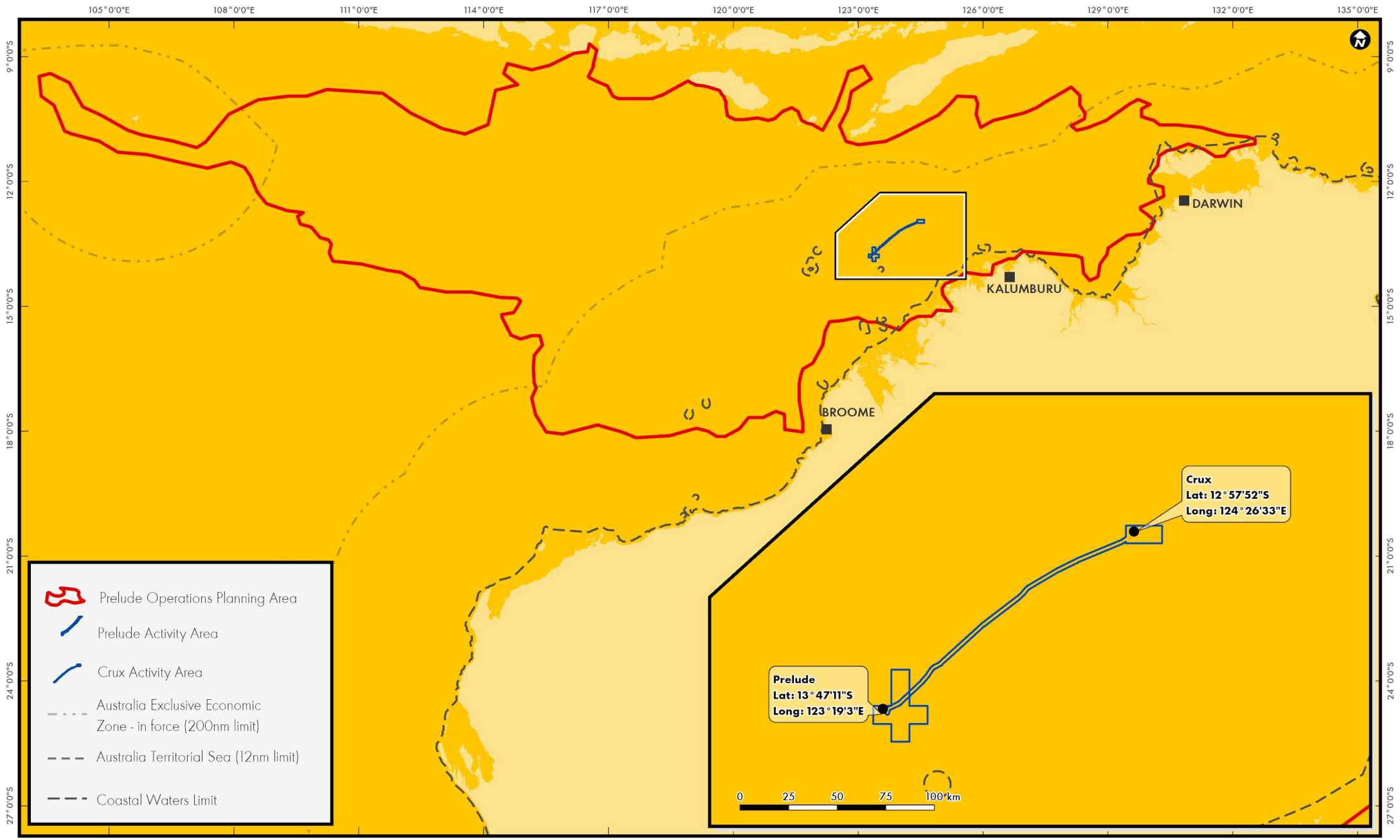
You may request that sensitive information you provide is not published.

GLOSSARY

Term	Definition
Functions	Refers to "a power or duty to do something"
Activities	To be read broadly and is broader than the definition of 'activity' in regulation 5 of the Environment Regulations and is likely directed to what the relevant person is already doing
Interests	To be construed as conforming with the accepted concept of "interest" in other areas of public administrative law includes "any interest possessed by an individual whether or not the interest amounts to a legal right or is a proprietary or financial interest or relates to reputation"
Reasonable Period	The titleholder must allow a relevant person a reasonable period for the consultation.
Sufficient Information	For the purpose of the consultation, the titleholder must give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person.
Relevant Persons	In the course of preparing an environment plan, or a revision of an environment plan, a titleholder must consult each of the following (a relevant person): a) each Department or agency of the Commonwealth to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant; b) each Department or agency of a State or the Northern Territory to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant; c) the Department of the responsible State Minister, or the responsible Northern Territory Minister; d) a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan; e) any other person or organisation that the titleholder considers relevant.

CONTACT US Community Hotline: 1800 059 152 Email: SDA-crux-project@shell.com www.shell.com.au/crux

Shell Australia welcomes any feedback on Environment Plan submissions, including requests for further information.
If you have functions, interests or activities that may be affected, or you know someone else who might have, Shell Australia invites you to get in touch. For further information about our consultation obligations under the Offshore Petroleum and Greenhouse Gas Storage Act 2006, visit www.nopsema.gov.au



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CAMPAIGN POPS – HALF PAGE HORIZONTALS

NEWS 11

Our fast-tracked teachers

One-year graduate diplomas see hundreds of new staff filling schools

EXCLUSIVE BETHANY HIATT

Hundreds of new teachers are being fast-tracked into WA schools this year after two universities revived their one-year teaching qualifications to help tackle crippling staff shortages.

In response to WA's teacher shortage, Curtin University last year led the reintroduction of a one-year Graduate Diploma in Secondary Education for students who had already done a three-year undergraduate degree in another field.

In just one year, the course has produced 246 graduates ready for work in WA primary and secondary schools.

"The teacher shortage is having a major impact on WA schools and families," Curtin's School of Education head Jeff Brooks said.

"We heard our schools' call for more teachers as soon as possible and have provided an agile response to help them address the challenges they're facing."

Aimed at getting teachers into classrooms faster, the move came after the number of new teachers graduating from Australian universities plummeted when the popular "grad dip" pathway was replaced with a two-year postgraduate masters degree.

Edith Cowan University also reintroduced a 12-month qualification last year which has turned out more than 50 teachers. This year, ECU is also offering a new one-year Graduate Diploma in Early Childhood Teaching to help meet growing demand for kindergarten teachers and childcare educators.

Professor Brooks said early enrolments for Curtin's course this year indicated numbers were increasing.

"The Graduate Diploma of Education will continue to add even more qualified and classroom-ready graduates to the teaching pool, at a time of immense need," he said.

Joanne Kennedy has just one assignment to finish before she is fully qualified but she has already scored a job as an English teacher at Como Secondary College.

The 26-year-old went back to university in 2020 to do an arts degree online — because she regretted dropping out when she was younger — while still working full-time in a financial planning firm and raising her son.

Coming from "a family of teachers", she had always wanted to be a teacher but could not afford to add another two years of study to do a masters degree.

When she heard about Curtin's one-year course, she signed up immediately.

"It has been a lot of work, but very rewarding for me," she said.

"And I'm still pinching myself that I'm actually a teacher.

"One thing that really surprised me was there were a lot of people in my age group doing this. I thought I'd be the dinosaur, but I wasn't. I was really surprised by the amount of lawyers, physiotherapists and occupational therapists."

Newly graduating teacher Joanne Kennedy at Como Secondary College. Picture: Danella Bevis

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INPEX KOGAS OPIC

The West Australian – HPH
Insert 1 – 8th Feb 2025

NEWS 9

Skipper and tour company fined for Falls boat crash

EMILY MOULTON

The ex-skipper of an adventure tour boat that crashed at one of WA's most scenic tourist destinations — injuring several passengers — has been fined $13,000.

Stuart James Whitson, who is highly experienced boat driver who had been seconded to the firm to develop its safety management systems, miscalculated the approach between the cliffs of Horizontal Falls.

It resulted in the vessel, Falls Express, colliding into a rock face.

It comes as Perth Magistrates Court court on Thursday released footage showing the moment before the impact.

The court was told that despite Whitson's years of experience and the fact that he was responsible for training other staff on how to cross the dangerous stretch of water, he made a split second and significant "error of judgment" by steering the boat through the 17m gap in the wrong angle.

"This meant the collision with the rock face was unable to be avoided," Magistrate Jacoba Scott said as she handed down her sentence.

"Ultimately, he wrongly assessed the risk and proceeded with the off-centre approach which resulted in the consequences."

The court was told that the Falls Express, run and owned by tour operator Journey Beyond, had 35 passengers aboard on May 2021.

Eighteen of them were hurt in the incident.

Of those hurt, six provided the court with victim impact statements detailing the pain and trauma they still endure.

Whilst most acknowledged that they were on an adventure tour, they expected to complete the experience safely.

Ms Scott told the court that one passenger spoke of how for several hours she was terrified that she had broken her back and spent months in rehabilitation learning how to walk again.

Another spoke of not only being in immense pain but the anguish of being separated from her partner who had been transported to another hospital.

They were not able to see each other because of COVID restrictions at the time.

The hearing was told that Whitson tried to "power through" through narrow gap despite being at the wrong angle.

Character references for Whitson were read to the court, including one from a former Journey Beyond general manager who described him as a professional and knowledgeable worker who introduced higher safety operations at the company.

He also said Whitson was not a "cowboy" but rather someone who took safety seriously.

It was also revealed that the 41-year-old father-of-two still planned to work as a skipper but would not operate passenger vessels.

Ms Scott said that while she found Whitson failed in his duties to safely protect passengers and the vessel by his miscalculation, his actions were not "deliberate or intentionally reckless".

She fined him $13,000.

The court was also told that after the incident, Journey Beyond paid out about $2 million in settlements with passengers and estimated it lost more than $4 million as a result of the crash.

Ms Scott fined Journey Beyond $15,000.

Edward Whitson Picture: Justin Benson-Cooper

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NEWS 3

Top cop to tackle drugs & DV

NATASHA CLARK

Newly appointed Kimberley superintendent John Hutchison always knew he would return to the region that shaped his path in policing.

"It's always been in the back of my mind that I would come back here, so I jumped on the opportunity when it presented," Supt Hutchison said.

The decorated superintendent, who has served in the WA Police Force for nearly 40 years, has specialised in major crime investigations and organised crime.

Notably, he led prominent operations Shipton and Beach, which resulted in the largest drug seizures in Australia's history, targeting complex organised crime networks.

Drawing from his experience dismantling drug rings, Supt Hutchison plans to apply his expertise to combat drug trafficking in the Kimberley.

"You can have little bits of organised crime in these communities," he said.

He said gathering intelligence on drug traffickers was crucial to preventing drug circulation in the region.

"The way we come across caches of drugs that somebody might find out to the people of Broome is intelligence driven," he said.

"And that relies on the public sharing information with police."

The Kimberley region is battling high rates of family violence, a challenge Supt. Hutchison is committed to addressing head-on. In 2022-23, the rate of family assaults in the Kimberley was more than 16.5 times that of the metropolitan area.

"Family violence is absolutely abhorrent," he said.

"We will do everything we can to prevent it, by doing victim engagement, providing safe places when people are at high risk, and by really chasing up offenders and putting them before the courts."

While combating drug trafficking is a key focus, Supt. Hutchison is also committed to fostering community relationships.

He believes that effective policing is rooted in trust and engagement.

His family recalls a recent bustling trip with 30 local children and community liaison officers in Halls Creek, a hands-on initiative designed to build positive connections between youth and police.

"We try to help kids across the State see police in a positive light for several reasons," he said.

"Number one, if they do get in trouble, they feel comfortable coming to police for help.

"Number two, it's beneficial if they grow up with a positive attitude towards police and their surrounding communities."

The superintendent said despite only being in the first month of his role, he hadn't once regretted his decision to move to the Kimberley.

Supt John Hutchison Picture: Natasha Clark

Welcome to LOOMA COMMUNITY

LOOMA COMMUNITY SCHOOL

Supt John Hutchison always knew he'd return to the Kimberley.

Shell Australia invites the Kimberley community to get in touch

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community

NSW Koori man Toby Wright, left, with Ziah Singh.

Catching up at Richmond State School oval were Edward Santo, Ivor Kerr-Kennedy and Bo Morre-Reid who played for different teams.

Gudaba Riley and Rex Ross were at Centenary Park at lunch.

Joeziah Briggs from Atherton, left, with Noel Rose.

Simon Leo was at the Goldfield Sporting Complex ready to play with West Inniglies.

From left are Toni Feltes, baby Zayne Ross, aged two, and Chelsie Dahler.

Proud Gudjuda man George Reid with his children Hayze, aged two, Jasmine, nine and Ashton, six.

Shell Australia invites the Kimberley, Pilbara and Northern Territory community to get in touch

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The Pearl at the Heart of Shell artwork

This artwork represents Shell Australia's reconciliation journey and is inspired by the history of shell use in Aboriginal and Torres Strait Islander cultures.

The artwork was developed by Tami O'Shea and Jenna Lee.

Prelude FLNG Joint Venture Partners
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www.koorimail.com THE KOORI MAIL, WEDNESDAY, FEBRUARY 12, 2025 | 17

Koori Mail – HPH
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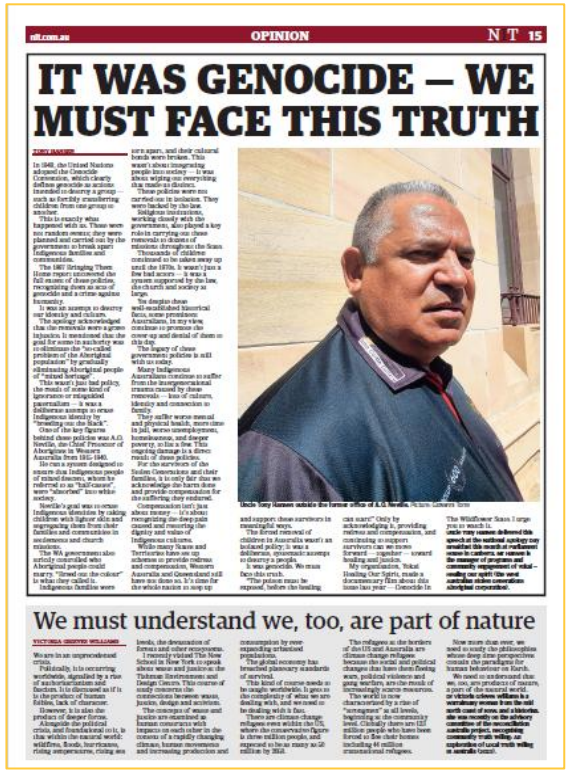

NIT Page 15
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(National)

NIT Page 16
25th Feb (WA) & 26th Feb
(National)

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Insert 3 – 13th March 2025

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Koori Mail – HPH
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NIT

NATIONAL INDIGENOUS TIMES

Fast & glorious

Artist's supercar heads to Darwin

STYLE UP STARTS PAGE 9

HISTORIC LAND RIGHTS VICTORY

High Court rules for Gumatj over mining lease compensation

NIT Cover Page
25th March (WA) & 26th March (National)

12 NT STYLE UP

Exhibition shines light on darkness of prison

BUILDING AN EXCEPTIONAL FUTURE

We create a safe environment for all and are committed to providing opportunities for women across our operations.

NIT Page 12
25th March (WA) & 26th March (National)

STYLE UP NT 13

Bold vision for street fashion

Shell Australia invites the Western Australia and Northern Territory community to get in touch

NIT Page 13
25TH March (WA) & 26th March (National)

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NEWS 11

THE SHADOW CABINET

Zempilas hits back at Cook over WA 'DOGE' swipe

NO SHADOW OF DOUBT FOR BAZ

JESSICA PAGE

Basil Zempilas has accused the Premier of being afraid of scrutiny, rejecting claims his new shadow cabinet was inspired by Donald Trump's Department of Government Efficiency.

The new portfolio of Zempilas-tion and public service reform, assigned to first-time MP Jonathan Huston, was quickly branded a "DOGE sort of effort" by Roger Cook.

"If the Premier's making comments like that it suggests to me that he is fearful of proper scrutiny," Mr Zempilas, pictured left, said on Friday.

"We know that over-regulation and red tape from the government has held free enterprise and small business back and Jonathan Huston will give it the proper scrutiny that it deserves."

The former Croisaant Express chairman, who served in the Army's intelligence corps, Mr Huston was also given responsibility for veterans and small business.

Former Liberal leader Libby Mettam, who is the party's only re-elected MLA, will take on defence industries and AUKUS, as well as health and prevention of domestic violence.

Adam Hort, who won the seat of Kalamunda by just 82 votes, becomes shadow police minister, while Liam Staltari has been named shadow education minister.

David Bolt takes on housing, homelessness and the environment, while Cottesloe MP Sandra Brewer had already been named shadow treasurer.

"The make-up of the shadow cabinet demonstrates a breadth of real-world experience," Mr Zempilas said.

Former deputy leader Steve Martin has given up hosting to become shadow transport minister, while factional powerbroker Nick Goiran remains shadow attorney-general.

"The old guard of the Liberal Party has always been in charge and continues to be in charge," Mr Cook said.

"That's why you see those extreme policies taking hold ... Nick Goiran and 'The Dan', however they label themselves today, are still in charge and now they've got a new honorary member, Basil Zempilas."

LIBS

Basil Zempilas MLA
Leader of the Opposition; State Development, Trade and Investment; Citizenship and Multicultural Interests

Libby Mettam MLA
Deputy Leader of the Opposition; Defence Industries and AUKUS; Minister of Opposition Business

David Bolt MLA
Housing and Homelessness; Environment and Climate Science and Innovation

Sandra Brewer MLA
Treasurer; Women's Interests

Nick Goiran MLC
Attorney General; Child Protection

Adam Hort MLA
Police; Corrective Services; Youth

Jonathan Huston MLA
Delegate to Small Business; Public Sector Reform; Veterans

Steve Martin MLC
Transport; Ports; Communities

Tjorn Sibma MLC
Finance; Training and Workforce Development; Major Infrastructure

Liam Staltari MLA
Education; Early Childhood; Disability Services; Heritage

Steve Thomas MLC
Energy; Industrial Relations

Neil Thomson MLC
Planning and Lands; Aboriginal Affairs; Sports

NATS

Shane Love MLA
Leader of The Nationals WA; Regional Development; Mines and Petroleum; Electoral Affairs

Peter Rundle MLA
Deputy Leader of The Nationals WA; Water; Sport and Recreation

Steven Kotta MLA
Forestry; Aged Care

Julie Freeman MLC
Road Safety; Casino Industries; Assisting the Shadow Minister for Regional Development

Rob Horstman MLC
Emergency Services; Volunteering

Lachlan Hunter MLA
Agriculture and Food; Racing and Gaming

Scott Leary MLA
Commerce; Tourism

Kimberley Warr
Local Government; Fisheries

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The West Australian – HPH
Insert 4 – 05th April 2025

NEWS 9

Sam Lovell on the set of The Tale Of Mr Kimberley (2022). Pictures: Courtesy of State Library of Western Australia

leather-making and saddlery tools, musical instruments and photos taken from his time working as a stockman, offering a unique perspective of life in the Kimberley.

It also includes recordings of Mr Lovell's oral history and a video of Mr Lovell returning to significant places from his early life including Cable Beach where he was born, Nookanbah where he was taken and Moola Bulla where he spent most of his childhood and adolescence.

Bart Pigram, who co-curated the exhibition with Sarah Ts said Mr Lovell's tourism work in the Kimberley laid out the blueprint for future operators.

"To be able to break into the tourism industry, excel in the industry and to also maintain cultural and environmental integrity across most of the Kimberley region pretty much set the standard for all operators that followed," he said.

"We may not have the diverse range of Aboriginal tourism operators in Western Australia today if not for the endeavour of Sam and Rosita Lovell."

The exhibition allows visitors to discover Mr Lovell's life as a drover, road builder, tour guide and country musician through photos and videos and is open with free admission until July 31 at the WA State Library.

Top: Sam Lovell at Napier Downs in 1956. Above, Sam Lovell performing with members of the Cox family, Tamworth, 2007.

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Insert 5 – 3rd April 2025

NEWS 7

of true Kimberley legend

The exhibition includes Mr Lovell's Order of Australia Medal, leather-making and saddlery tools, musical instruments and photos taken from his time working as a stockman.

It also includes recordings of Mr Lovell's oral history and a video of Mr Lovell returning to significant places from his early life including Cable Beach where he was born, Nookanbah where he was taken and Moola Bulla where he spent most of his childhood and adolescence.

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Sam Lovell on the set of The Tale Of Mr Kimberley (2022) and left, performing with members of the Cox family in Tamworth in 2002. Pictures: Courtesy of State Library of Western Australia

Shell Australia invites you to come and talk to us about Prelude

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If you are interested in learning more, Shell Australia invites you to join us at a drop-in session as follows:

- Broome
  Date: 08 April 2025 | Time: 9:00 - 18:00
  Location: Mangrove Hotel
- Derby
  Date: 09 April 2025 | Time: 9:30 - 17:30
  Location: Derby Professional Centre

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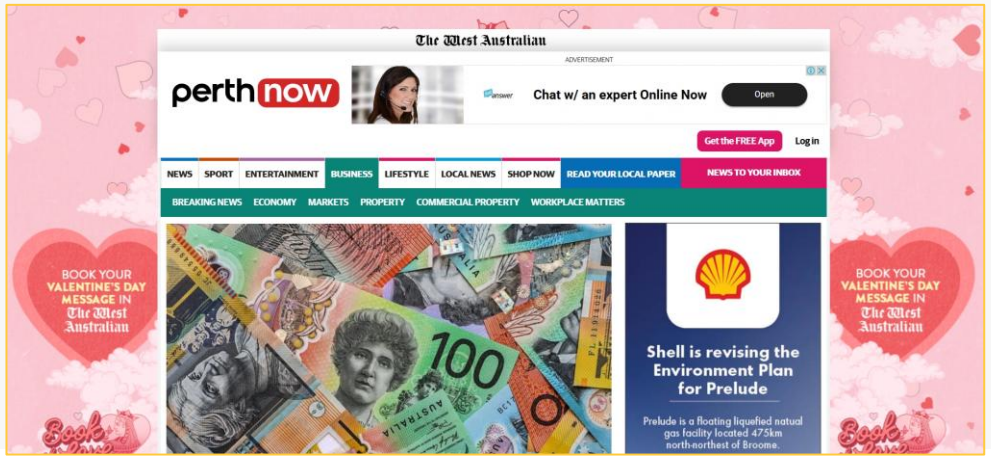

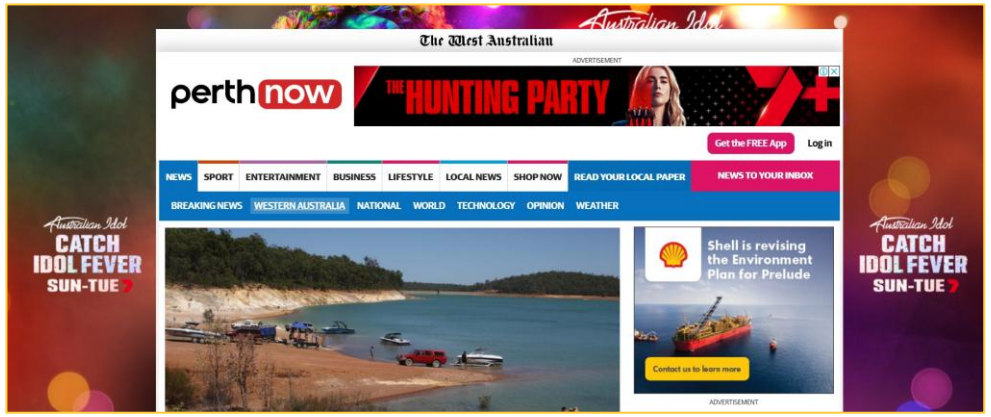

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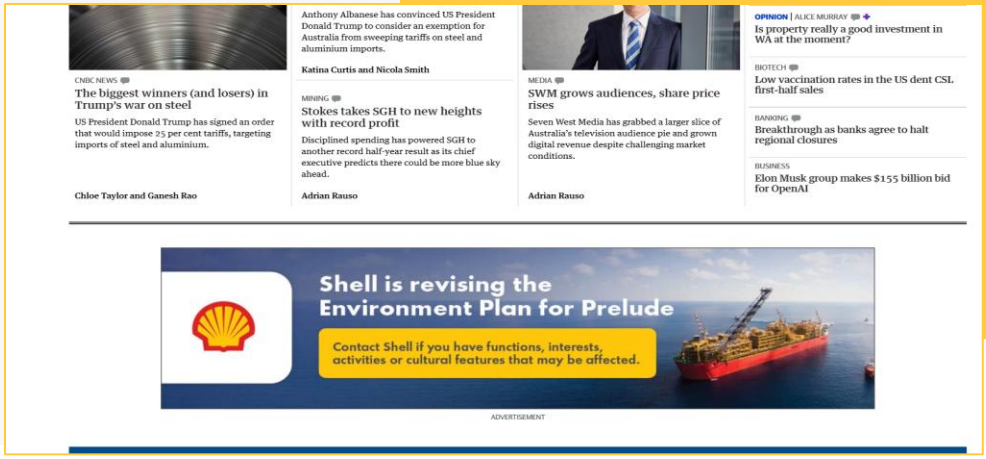

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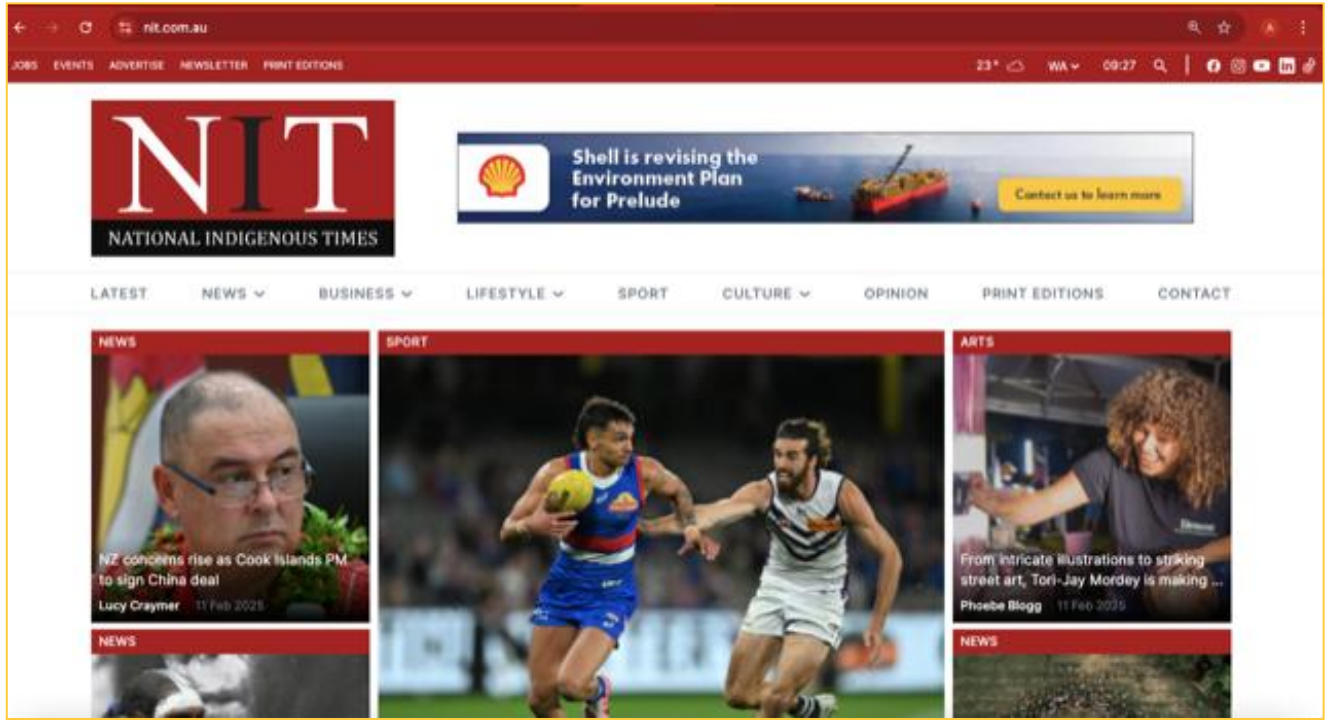

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ARN (Unfortunately, our aircheck player can only backdate 30 days, thus we are unable to gain access to airchecks)

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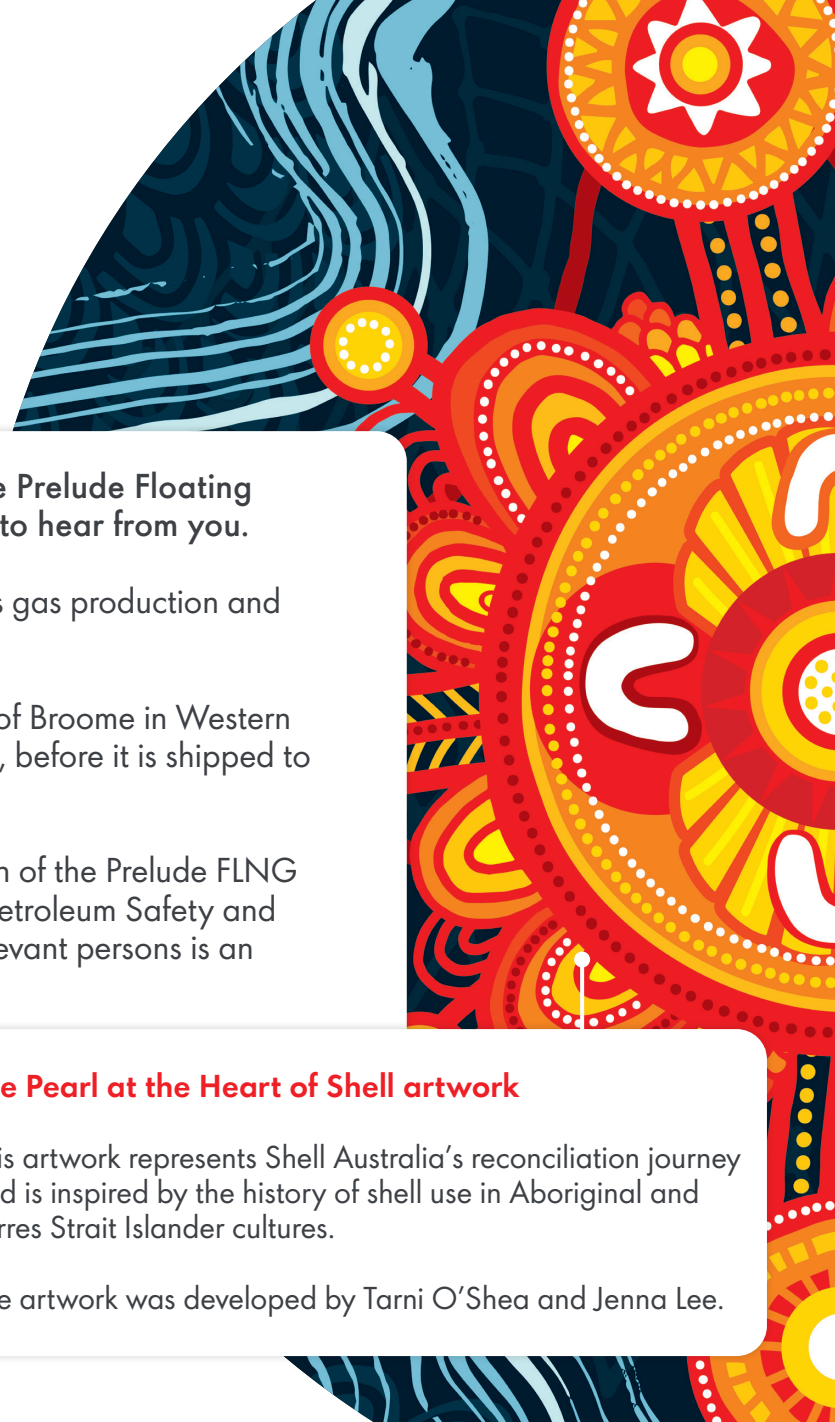

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In Australia, Shell is an integrated energy solutions business which includes gas production and liquefaction, as well as renewable power and energy solutions.

Prelude is moored offshore approximately 475 kilometres north-northeast of Broome in Western Australia. Prelude extracts, liquefies and stores gas and condensate at sea, before it is shipped to customers.

Shell Australia is seeking to consult in preparation of the five-yearly revision of the Prelude FLNG Environment Plan (EP). The EP will be submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). Consultation with relevant persons is an important part of this approval.

Please respond by 31 May 2025.

For more information, please visit:
www.shell.com.au/prelude

The Pearl at the Heart of Shell artwork

This artwork represents Shell Australia's reconciliation journey and is inspired by the history of shell use in Aboriginal and Torres Strait Islander cultures.

The artwork was developed by Tarni O'Shea and Jenna Lee.

Prelude FLNG Joint Venture Partners

INPEX KOGAS OPIC

Shell Australia invites the Darwin community to get in touch

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www.shell.com.au/prelude

Prelude FLNG Joint Venture Partners

INPEX KOGAS KOREA GAS CORPORATION OPIC

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For more information, please visit:
www.shell.com.au/prelude

Prelude FLNG Joint Venture Partners

INPEX KOGAS KOREA GAS CORPORATION OPIC

3.14 Radio Script

Shell is preparing the five-yearly revision of the Prelude Environment Plan.

Prelude is our floating natural gas facility, located approximately 475km offshore from Broome.

We would like to hear from you if you have functions, interests, activities or cultural heritage features that may be affected.

Contact us today by visiting shell dot com dot au forward slash prelude. Responses required by the 31 of May.

[Sonic outro 2 secs]

Prelude FLNG Joint Venture Partners

INPEX KOGAS OPIC

Shell Australia invites you to come and talk to us about Prelude

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If you are interested in learning more, Shell Australia invites you to join us at a drop-in session as follows:

- **Broom**

  Date: 08 April 2025 | **Time:** 9:00 - 18:00
  Location: Mangrove Hotel

- **Derby**

  Date: 09 Arpil 2025 | **Time:** 9:30 - 17:30
  Location: Derby Professional Centre

Prelude FLNG Joint Venture Partners

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If you are interested in learning more, Shell Australia invites you to join us at a drop-in session as follows:

- **Darwin**

Date: Wednesday, 30 April 2025 | **Time:** 12:00 - 18:00
Location: NTIBN

NORTHERN TERRITORY INDIGENOUS BUSINESS NETWORK

Prelude FLNG Joint Venture Partners

INPEX KOGAS OPIC

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If you are interested in learning more, Shell Australia invites you to join us at a drop-in session as follows:

- **Djarindjin**

Date: 30 May 2025 | **Time:** 09:00 - 12:00
Location: Djarindjin Aboriginal Corporation

Prelude FLNG Joint Venture Partners

INPEX KOGAS OPIC

SHELL AUSTRALIA INVITES YOU TO COME AND TALK TO US ABOUT PRELUDE

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If you are interested in learning more, Shell Australia invites you to join us at a drop-in session as follows:

- **Wyndham**

  Date: 18 March 2025 | **Time:** 9:30 - 16:00
  Location: Ngnowar Aerwah Aboriginal Corporation

- **Kununurra**

  Date: 19 March 2025 | **Time:** 8:00 - 17:00
  Location: Mirima Language Centre

Prelude FLNG Joint Venture Partners

INPEX KOGAS OPIC

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If you are interested in learning more, Shell Australia invites you to join us at a community information session as follows:

- **Broome**

Date: 08 April 2025 | **Time:** 7:15 - 8:30
Location: Mangrove Hotel

Prelude FLNG Joint Venture Partners

INPEX KOGAS OPIC

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- **Darwin**

Date: Wednesday, 30 April 2025 | **Time:** 9:30 - 11:30
Location: NTIBN

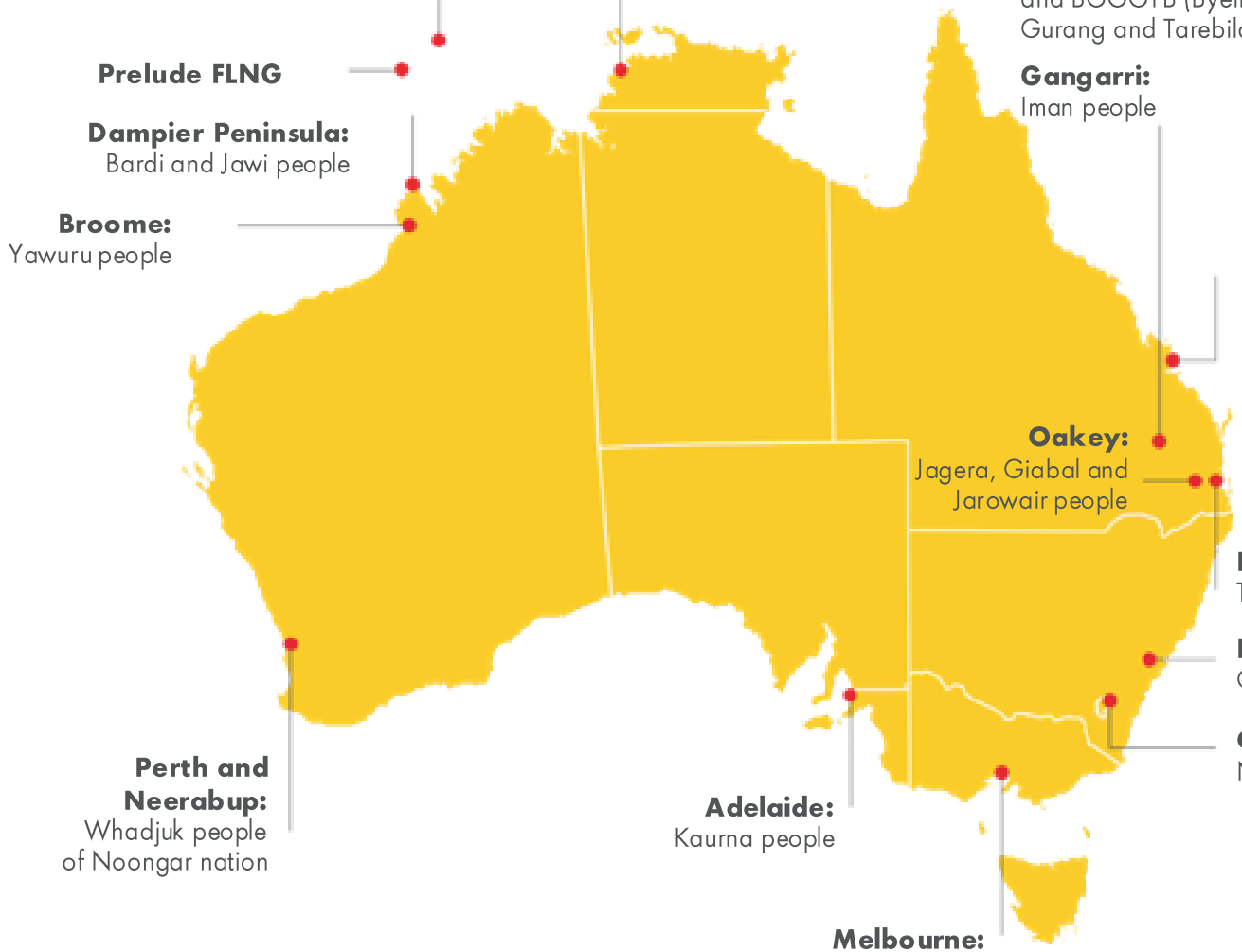
NORTHERN TERRITORY INDIGENOUS BUSINESS NETWORK

Prelude Environmental Plan Consultation Broome

Shell Australia

8th April 2025

Shell Australia respectfully acknowledges the many Traditional Owner groups of the lands and waters on which we operate and pay our respect to the Elders past, present and emerging.



Upstream operations:
Iman, Barunggam, Bigambul, Mandandanji and BCJWY (Barunggam, Cobble Cobble, Jarowair, Western Wakka Wakka and Yiman) people

Upstream pipeline:
Gangulu, Warrabul, Wakka Wakka, Wulli Wulli and BGGGTB (Byellee, Gooreng Gooreng, Gurang and Tarebilang Bunda) people

Gangarri:
Iman people

Midstream:
BGGGTB (Byellee, Gooreng Gooreng, Gurang and Taribelang Bunda) people

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Definitions & cautionary note

Cautionary Note

The companies in which Shell plc directly and indirectly owns investments are separate legal entities. In this presentation "Shell", "Shell Group" and "Group" are sometimes used for convenience where references are made to Shell plc and its subsidiaries in general. Likewise, the words "we", "us" and "our" are also used to refer to Shell plc and its subsidiaries in general or to those who work for them. These terms are also used where no useful purpose is served by identifying the particular entity or entities. ''Subsidiaries'', "Shell subsidiaries" and "Shell companies" as used in this presentation refer to entities over which Shell plc either directly or indirectly has control. Entities and unincorporated arrangements over which Shell has joint control are generally referred to as "joint ventures" and "joint operations", respectively. "Joint ventures" and "joint operations" are collectively referred to as "joint arrangements". Entities over which Shell has significant influence but neither control nor joint control are referred to as "associates". The term "Shell interest" is used for convenience to indicate the direct and/or indirect ownership interest held by Shell in an entity or unincorporated joint arrangement, after exclusion of all third-party interest.

Forward-Looking Statements

This presentation contains forward-looking statements (within the meaning of the U.S. Private Securities Litigation Reform Act of 1995) concerning the financial condition, results of operations and businesses of Shell. All statements other than statements of historical fact are, or may be deemed to be, forward-looking statements. Forward-looking statements are statements of future expectations that are based on management's current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in these statements. Forward-looking statements include, among other things, statements concerning the potential exposure of Shell to market risks and statements expressing management's expectations, beliefs, estimates, forecasts, projections and assumptions. These forward-looking statements are identified by their use of terms and phrases such as "aim", "ambition", ''anticipate'', ''believe'', ''could'', ''estimate'', ''expect'', ''goals'', ''intend'', ''may'', "milestones", ''objectives'', ''outlook'', ''plan'', ''probably'', ''project'', ''risks'', "schedule", ''seek'', ''should'', ''target'', ''will'' and similar terms and phrases. There are a number of factors that could affect the future operations of Shell and could cause those results to differ materially from those expressed in the forward-looking statements included in this [report], including (without limitation): (a) price fluctuations in crude oil and natural gas; (b) changes in demand for Shell's products; (c) currency fluctuations; (d) drilling and production results; (e) reserves estimates; (f) loss of market share and industry competition; (g) environmental and physical risks; (h) risks associated with the identification of suitable potential acquisition properties and targets, and successful negotiation and completion of such transactions; (i) the risk of doing business in developing countries and countries subject to international sanctions; (j) legislative, judicial, fiscal and regulatory developments including regulatory measures addressing climate change; (k) economic and financial market conditions in various countries and regions; (l) political risks, including the risks of expropriation and renegotiation of the terms of contracts with governmental entities, delays or advancements in the approval of projects and delays in the reimbursement for shared costs; (m) risks associated with the impact of pandemics, such as the COVID-19 (coronavirus) outbreak; and (n) changes in trading conditions. No assurance is provided that future dividend payments will match or exceed previous dividend payments. All forward-looking statements contained in this presentation are expressly qualified in their entirety by the cautionary statements contained or referred to in this section. Readers should not place undue reliance on forward-looking statements. Additional risk factors that may affect future results are contained in Shell plc's Form 20-F for the year ended December 31, 2021 (available at www.shell.com/investor and www.sec.gov). These risk factors also expressly qualify all forward-looking statements contained in this [report] and should be considered by the reader. Each forward-looking statement speaks only as of the date of this presentation, 27 April 2023. Neither Shell plc nor any of its subsidiaries undertake any obligation to publicly update or revise any forward-looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward-looking statements contained in this presentation.

Shell's net carbon footprint

Also, in this presentation we may refer to Shell's "Net Carbon Footprint" or "Net Carbon Intensity", which include Shell's carbon emissions from the production of our energy products, our suppliers' carbon emissions in supplying energy for that production and our customers' carbon emissions associated with their use of the energy products we sell. Shell only controls its own emissions. The use of the term Shell's "Net Carbon Footprint" or "Net Carbon Intensity" are for convenience only and not intended to suggest these emissions are those of Shell plc or its subsidiaries.

Shell's net-Zero Emissions Target

Shell's operating plan, outlook and budgets are forecasted for a ten-year period and are updated every year. They reflect the current economic environment and what we can reasonably expect to see over the next ten years. Accordingly, they reflect our Scope 1, Scope 2 and Net Carbon Footprint (NCF) targets over the next ten years. However, Shell's operating plans cannot reflect our 2050 net-zero emissions target and 2035 NCF target, as these targets are currently outside our planning period. In the future, as society moves towards net-zero emissions, we expect Shell's operating plans to reflect this movement. However, if society is not net zero in 2050, as of today, there would be significant risk that Shell may not meet this target.

Forward Looking Non-GAAP measures

This presentation may contain certain forward-looking non-GAAP measures such as [cash capital expenditure] and [divestments]. We are unable to provide a reconciliation of these forward-looking Non-GAAP measures to the most comparable GAAP financial measures because certain information needed to reconcile those Non-GAAP measures to the most comparable GAAP financial measures is dependent on future events some of which are outside the control of Shell, such as oil and gas prices, interest rates and exchange rates. Moreover, estimating such GAAP measures with the required precision necessary to provide a meaningful reconciliation is extremely difficult and could not be accomplished without unreasonable effort. Non-GAAP measures in respect of future periods which cannot be reconciled to the most comparable GAAP financial measure are calculated in a manner which is consistent with the accounting policies applied in Shell plc's consolidated financial statements.

The contents of websites referred to in this presentation do not form part of this presentation.

We may have used certain terms, such as resources, in this presentation that the United States Securities and Exchange Commission (SEC) strictly prohibits us from including in our filings with the SEC. Investors are urged to consider closely the disclosure in our Form 20-F, File No 1-32575, available on the SEC website www.sec.gov.

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Agenda

1. Why we are here
2. Update on Shell in Australia
3. Background on Prelude
4. Prelude Environment Plan
5. Social Investment

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Why are we here today?

- We have a floating Liquefied Natural Gas facility off the Kimberley coast, called Prelude
- We are currently consulting with relevant persons on the five-yearly revision of the environment plan for Prelude
- To do this we need to make sure we:
  - Understand the environment we are developing in; and
  - Minimise any impact to the environment, including cultural heritage
- We've done a lot of research to understand the environment and our potential impact
- This information gets written in an Environment Plan and submitted to the regulator, NOPSEMA

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Shell in Australia

Shell's integrated energy solutions portfolio in Australia

PRELUDE

3.6 MTPA
LNG
LIQUIDS & CONDENSATE CAPACITY

QGC

8.5 MTPA
LIQUIDS & CONDENSATE CAPACITY

Non-Operated Ventures

2.8 MTPA
NORTH WEST SHELF

3.9 MTPA
GORGON

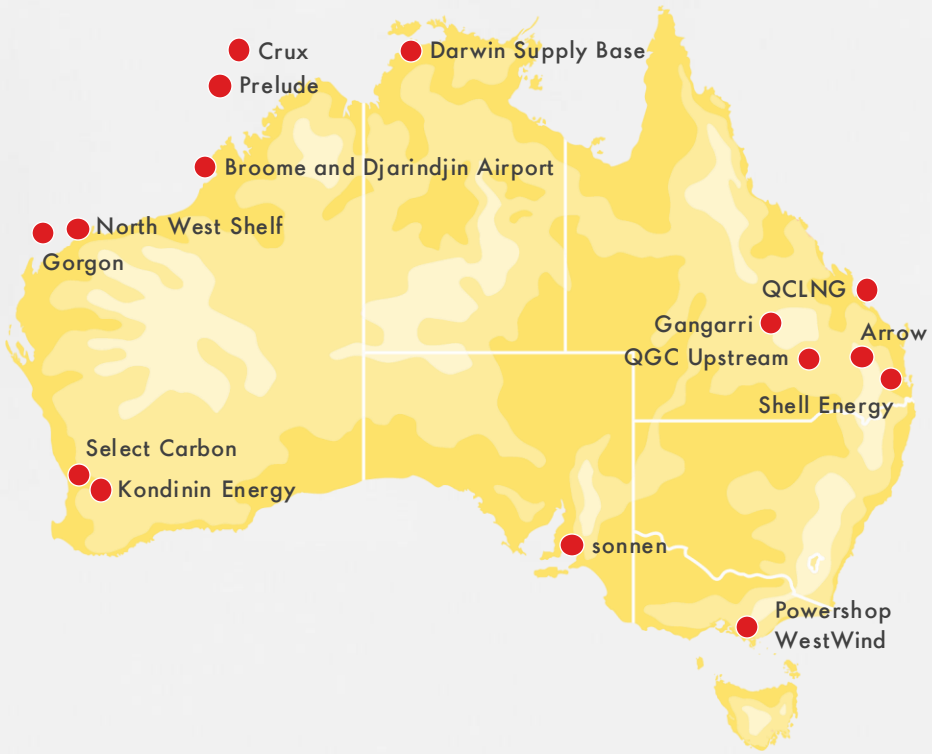
MORE THAN
8M TONNES
C02 INJECTED BY GORGON CCUS TO DATE

KONDININ ENERGY

370 MW
OF DEVELOPMENT ACROSS WIND, SOLAR AND BATTERY ENERGY STORAGE SYSTEM ASSETS

SelectCarbon

MILLIONS OF HECTARES
OF CARBON SEQUESTRATION PROJECTS ACROSS AUSTRALIA



POWERSHOP

200K+
RESIDENTIAL AND SMALL BUSINESS GAS AND ELECTRICITY CUSTOMERS

WestWind ENERGY

670 MW
WIND PROJECTS DELIVERED

arrow energy go further

27 YEAR
GAS SUPPLY AGREEMENT WITH QCLNG

Shell ENERGY

2nd LARGEST*
ELECTRICITY PROVIDER TO C&I BUSINESSES

sonnen

80%
YEARLY HOME ENERGY NEEDS MET WITH PV + sonnenBATTARIE

GANGARRI

120 MW
SOLAR DEVELOPMENT IN COMMISSIONING

RESTRICTED

* By load, based on Shell Energy analysis of publicly available data
Prelude, QGC, Gorgon and North West Shelf MTPA values represent Shell share
Gorgon CCUS total from CCS system startup in August 2019 to May 2023

Prelude

- Prelude is a Floating Liquefied Natural Gas (FLNG) facility located 475km north-northeast of Broome, Western Australia, in the Browse Basin.
- The Prelude FLNG facility is moored over the Prelude gas field in 250m water depth and more than 200km from the coastline.
- Prelude produces LNG, LPG and condensate.
- Prelude has an onshore supply base in Darwin

Location:
WA-44-L, in Commonwealth marine waters, 475 km north-north east of Broome in Western Australia

Facility Type:
Floating liquefied natural gas (FLNG) facility

Number of wells:
Seven

Production capacity:
3.6 million tonnes per annum (mtpa) LNG, 1.3 mtpa LPG, 1.3mtpa condensate

Water depths:
250m

Status:
In operation

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Prelude EP 5-Yearly Revision

- Prelude has been operating since 2018, with the first Prelude Operations Environment Plan (EP) accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in 2016.
- The first 5-yearly revision (the current Prelude Operations EP) was accepted by NOPSEMA in 2021.
- Shell plans to submit the next 5-yearly revision of the Prelude EP to NOPSEMA in late 2025.
- This revision will cover the receipt and processing of Crux gas on Prelude.

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The purpose of consultation

To give **relevant persons** an opportunity to provide input into:

- Shell's understanding of the existing environment which may be affected by proposed activities, including the cultural features of that environment;
- how Shell's activities might impact the existing environment including its cultural features; and
- how controls and mitigation measures may be adopted to protect what is important to you.

We want to hear from you if:

- your functions, interests, or activities, may be affected by the activities, risks and impacts described in the Environment Plan
- if you have cultural heritage interests or
- if you know someone else who may be affected.

We would like to know of other people or organisations who you think may be relevant for these activities too.

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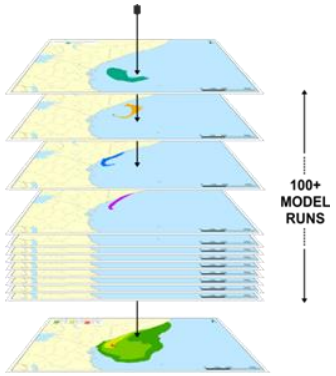
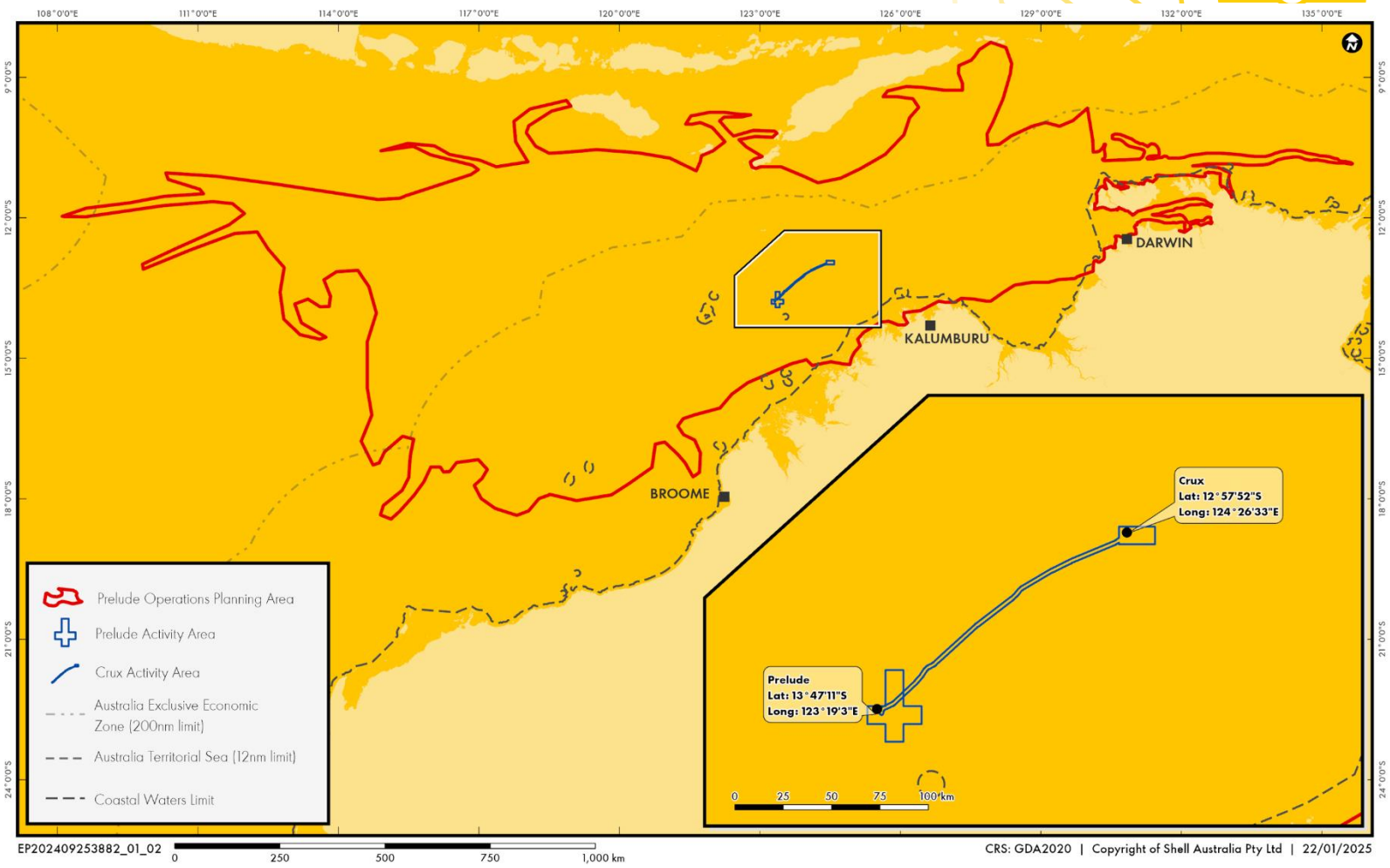
The Planning Area

- Shell develops an Environment Plan which looks at the key risks of that stage, and the size and scale of any impacts
- This is represented using a Planning Area.
- It shows the maximum outside limit of hundreds of individual, possible spill incidents all stitched together
- This takes into account weather, waves, currents, and other conditions.



Prelude Planning Area



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Browse Regional Oil Pollution Emergency Plan (BROPEP)

- BROPEP is Shell's regional spill contingency plan or OPEP.
- It documents Shell's Browse Basin regional spill response preparedness and first strike measures.
- Accepted by NOPSEMA under Drilling EP, and will be referred to for both the Prelude and Crux EPs.
- Shell has comprehensive capabilities and annual testing arrangements for BROPEP arrangements.

ScenarioC	Location Name	Latitude	Longitude	Depth (m)	Hazardous Liquid	Duration	Total Volume (m^3)
Loss of well control	Prelude Production Well	13°50"22" S	123°19"35.8" E	237	Well fluid	80 days	254,400
Loss of containment during product offloading (collision)	Prelude FLNG	13°47.2'S	123°19.0' E.	surface	Condensate	2 hours	42,000
Loss of containment of heavy fuel oil	Prelude FLNG	13°47.2'S	123°19.0' E.	surface	HFO	1 hour	1,000
Loss of containment of diesel	Prelude FLNG	13°47.2'S	123°19.0' E.	surface	Diesel	1 hour	750
Loss of containment of amine	Prelude FLNG	13°47.2'S	123°19.0' E.	surface	Amine	1 hour	1,000

Response strategies included are;

1. source control, including subsea dispersant application
2. monitoring (including operational and scientific monitoring (OSMP) arrangements)
3. Protection of sensitive receptors
4. shoreline clean-up and SCAT
5. containment and recovery
6. surface chemical dispersants
7. Oiled wildlife response

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Planned vs unplanned activities

Planned Activities

Known activities that result in physical impact to the environment and occur within close proximity to the activity area. Shell has processes to control the impact of these such as:

- Physical presence of infrastructure and vessels
- Seabed disturbance
- Artificial light emissions
- Underwater sound emissions
- Atmospheric emissions (including GHG emissions)
- Utility discharges
- Produced water discharge

Unplanned Activities

Unplanned events are very rare. Shell has to be prepared for them, to ensure adequate controls such as:

- Fauna interactions
- Accidental release of waste overboard
- Introduction of invasive marine species
- Vessel collision resulting in diesel spill
- Pipeline Rupture
- Loss of Well Control resulting in oil spill

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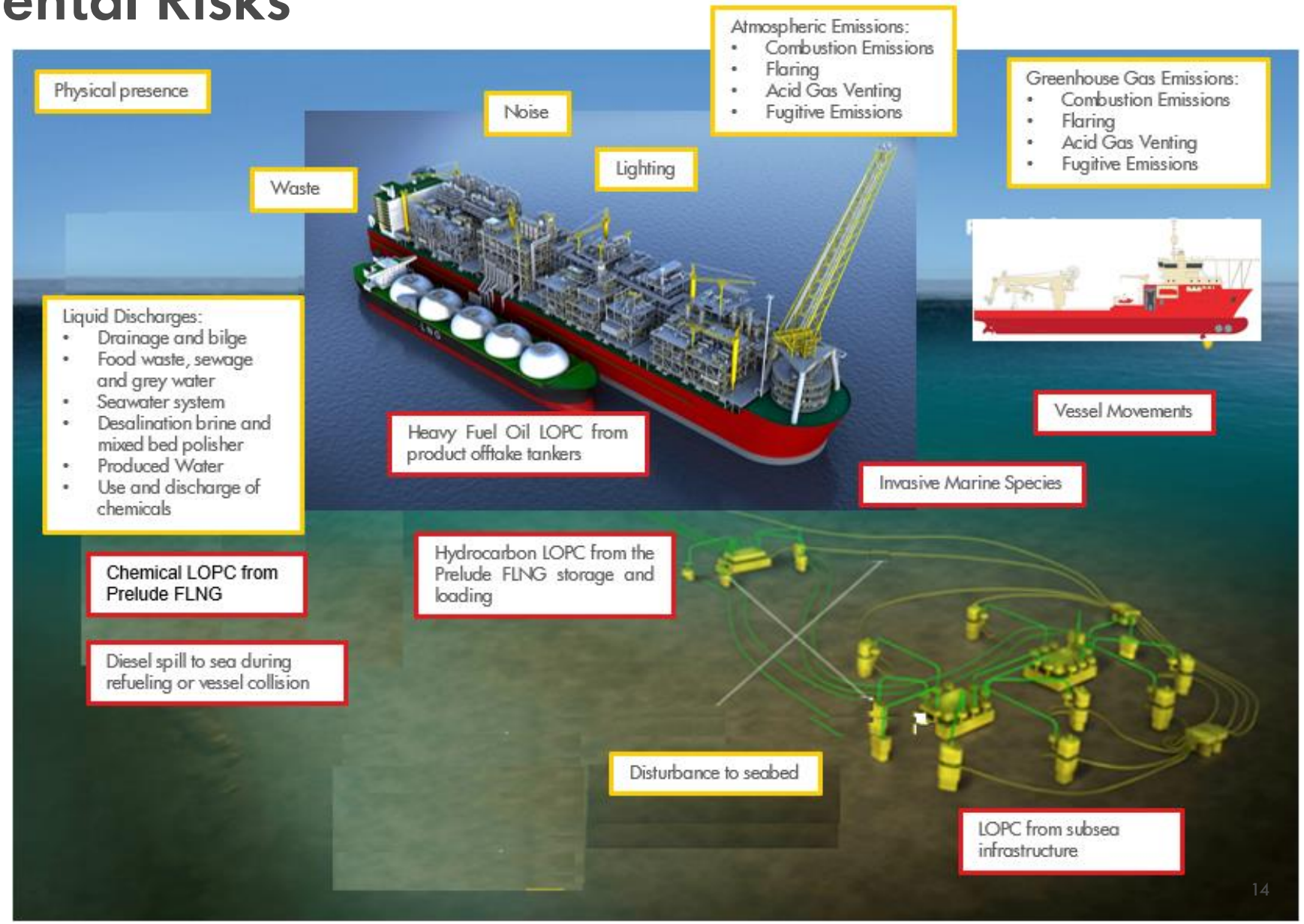
Our Top Environmental Risks

1. Greenhouse gas emissions
2. Liquid discharges
3. Unplanned spill events
4. Invasive Marine Species
5. Atmospheric emissions
6. Unplanned release of wastes
7. Vessel movements (unplanned interactions with marine fauna)



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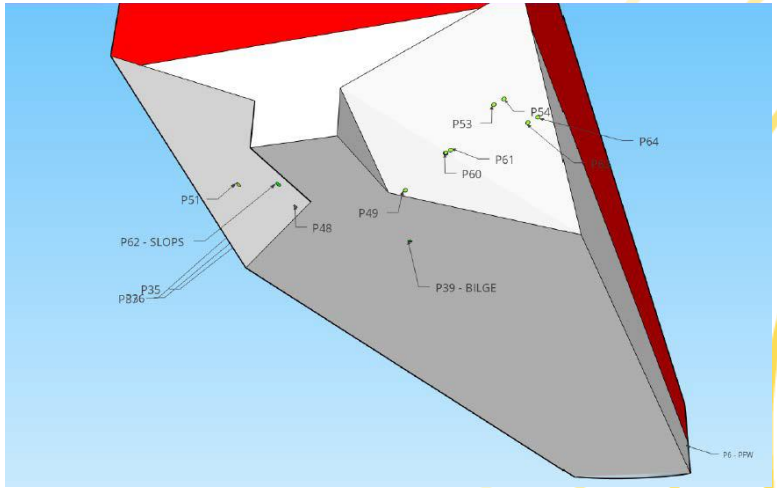
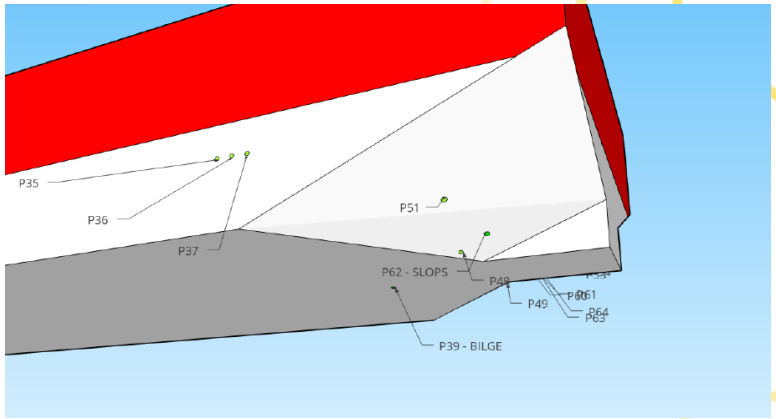
Liquid Discharges

There are several activities on Prelude that result in the discharge of liquid waste streams to the marine environment. These include:

- Drainage and bilge effluent
- Food waste, greywater and sewage
- Cooling Water (CW)
- Desalination brine, boiler blowdown and Mixed Bed Polisher (MBP) Effluent
- Produced Water (PW)
- Use and release of chemicals in ad-hoc discharges.

Note: unplanned spills, e.g. of chemicals or hydrocarbons, are considered separately





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Prelude Produced Water Management

- Prelude uses best available technology for offshore treatment (Macro Porous Polymer Extraction (MPPE) Package) in order to meet global and local standards for produced water discharge.
- The discharge limit for dispersed oil is a 24-hour average of 30 mg/L. Should this limit be exceeded, the water is manually diverted inboard for reprocessing.
- The produced water treatment system on Prelude is designed for a maximum 165 m3/hr discharge capacity.
- Oil in water is monitored using an online analyser.
- Produced water sample testing includes:
  - chemical characterisation
  - whole effluent ecotoxicological testing.
  - well understood discharge. Residual impacts from produced water are predicted to be slight (localised).

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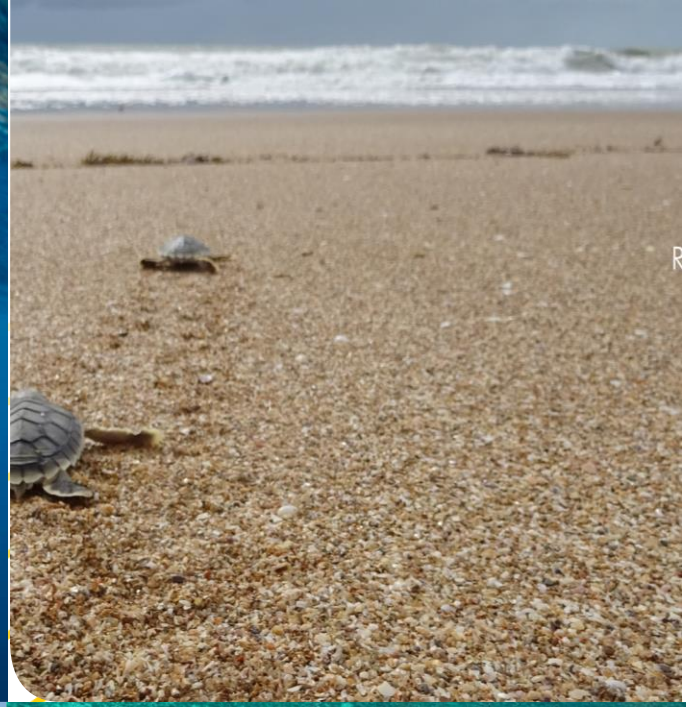
Existing Environment

- Sediments surrounding Prelude are very soft carbonate silts and sand.
- Low density filter feeders (sponges, soft corals).
- Situated outside of major migration routes for megafauna and cetaceans
- Closest landfall is Browse island (39 km), featuring some coral reef.
- Outside of critical breeding habitats for marine turtles.



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Where to from here?

- We want to stay in touch and maintain strong relationships
- Consult with the community
- Ask questions of us, Shell

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Following acceptance, the EP will be published online.

Let us know if anything you've told us is sensitive and we will ensure it's not published.

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Q&A

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Social Investment in Shell Australia

- Some of the longer-term larger programs we support provide sustained benefits to both our business and communities.
- When we talk to communities where we operate, these areas came up regularly and directed our investment in areas that align with our business:

SUPPORTING STRONGER FIRST NATIONS

We respect Indigenous people's deep connection to the land where we work.

We want to support them in rebuilding their identity and shaping their future.

REGIONAL ECONOMIC DEVELOPMENT

A diverse local economy benefits everyone.

Shell wants to be just one part of a thriving economy and support the growth of other sectors alongside our own.

JOBS FOR THE FUTURE

Local communities want young people to have meaningful jobs.

To access jobs with Shell and many other employers in the future, young people will need strong science skills, and foundational skills and support to learn.

- We're taking a fresh look at our social investment strategy for our programs being delivered from 2026-2028.
- Typically, we look at 3-year programs in the above areas to build long term social outcomes in above areas across a region or community.

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Social Investment Overview

Bardi Jawi Oorany Rangers, Kimberley Land Council

Assists sustainable employment for women rangers and protects the environment and culture through traditional caring for country practices on the Dampier Peninsula

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Madalah Scholarships

Traditional Owner groups have highlighted the need for youth education pathways to jobs, with tertiary scholarships being a preferred solution.

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Communities Funding

Shell's Prelude FLNG Communities Fund is offered to support Broome Shire, particularly the local communities in proximity to Shell's transit to Prelude.

Financial grants of up to $20,000 are available for community organisations and not-for-profit organisations to deliver community projects in these areas.

shellaustralia.smartygrants.com.au

- Regional Liveability
- Supporting Stronger First Nations
- Education and Training

- Opening mid April

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National Energy Technician Training Scheme (NETTS)

Our NETTS Apprenticeship program opens annually for entry-level intake to the Prelude offshore facility, this is a 4-year program with FIFO opportunities from the second year and very competitive salaries. Applications are now open to all ages across the below three trade intakes:

- Mechanical Technicians
- Instrumentation Electricians
- Process Plant Technicians

Please visit https://info.programmed.com.au/nettswa for advice on how to apply.

- Tali,Ella, Sharlize – 3 new maintenance apprentices as part of NETTS first year at TAFES ACEPT campus Perth. Then move to gas production facilities in WA & NT before heading out to Prelude

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SUPPLY OPPORTUNITIES-

- Shell is committed to giving Australian suppliers, local, regional and Indigenous businesses genuine opportunities to participate in our supply chain.
- To view opportunities and register your interest please visit Shell Australia's website www.shell.com.au **'becoming a supplier'** section. Or scan the QR code below

Roebuck Plains Station (Courtesy of ABC Landline: Chris Lewis)

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JOBS AND SPEND IN THE KIMBERLEY REGION

Over 157 jobs provided by Shell and its main contractors in the Kimberley region.

Approximately over $ 17 Million spent in 2024 by Shell and main contractors in the Kimberley region

Darwin Community Info Session

Shell Australia

30th April 2025

Shell Australia respectfully acknowledges the many Traditional Owner groups of the lands and waters on which we operate and pay our respect to the Elders past, present and emerging.

Why are we here today?

- We have a floating Liquefied Natural Gas facility off the Kimberley coast, called Prelude
- We are currently consulting with relevant persons on the five-yearly revision of the Environment Plan for Prelude
- To do this we need to make sure we:
  - Understand the environment we are developing in; and
  - Minimise any impact to the environment, including cultural heritage
- We've done a lot of research to understand the environment and our potential impact
- This information gets written in an Environment Plan and submitted to the regulator, NOPSEMA

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Shell in Australia

Shell's integrated energy solutions portfolio in Australia

PRELUDE

3.6 MTPA
LNG
LIQUIDS & CONDENSATE CAPACITY

QGC

8.5 MTPA
LIQUIDS & CONDENSATE CAPACITY

Non-Operated Ventures

2.8 MTPA
NORTH WEST SHELF

3.9 MTPA
GORGON

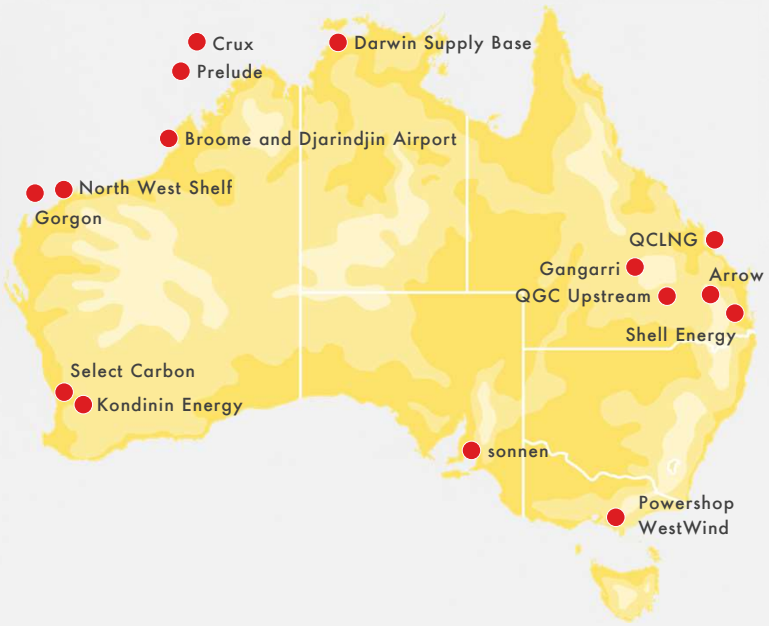
MORE THAN
8M TONNES
C02 INJECTED BY GORGON CCUS TO DATE

KONDININ ENERGY

370 MW
OF DEVELOPMENT ACROSS WIND, SOLAR AND BATTERY ENERGY STORAGE SYSTEM ASSETS

SelectCarbon

MILLIONS OF HECTARES
OF CARBON SEQUESTRATION PROJECTS ACROSS AUSTRALIA



POWERSHOP

200K+
RESIDENTIAL AND SMALL BUSINESS GAS AND ELECTRICITY CUSTOMERS

WestWind ENERGY

670 MW
WIND PROJECTS DELIVERED

arrow energy

27 YEAR
GAS SUPPLY AGREEMENT WITH QCLNG

Shell ENERGY

2nd LARGEST*
ELECTRICITY PROVIDER TO C&I BUSINESSES

sonnen

80%
YEARLY HOME ENERGY NEEDS MET WITH PV + sonnenBATTARIE

GANGARRI

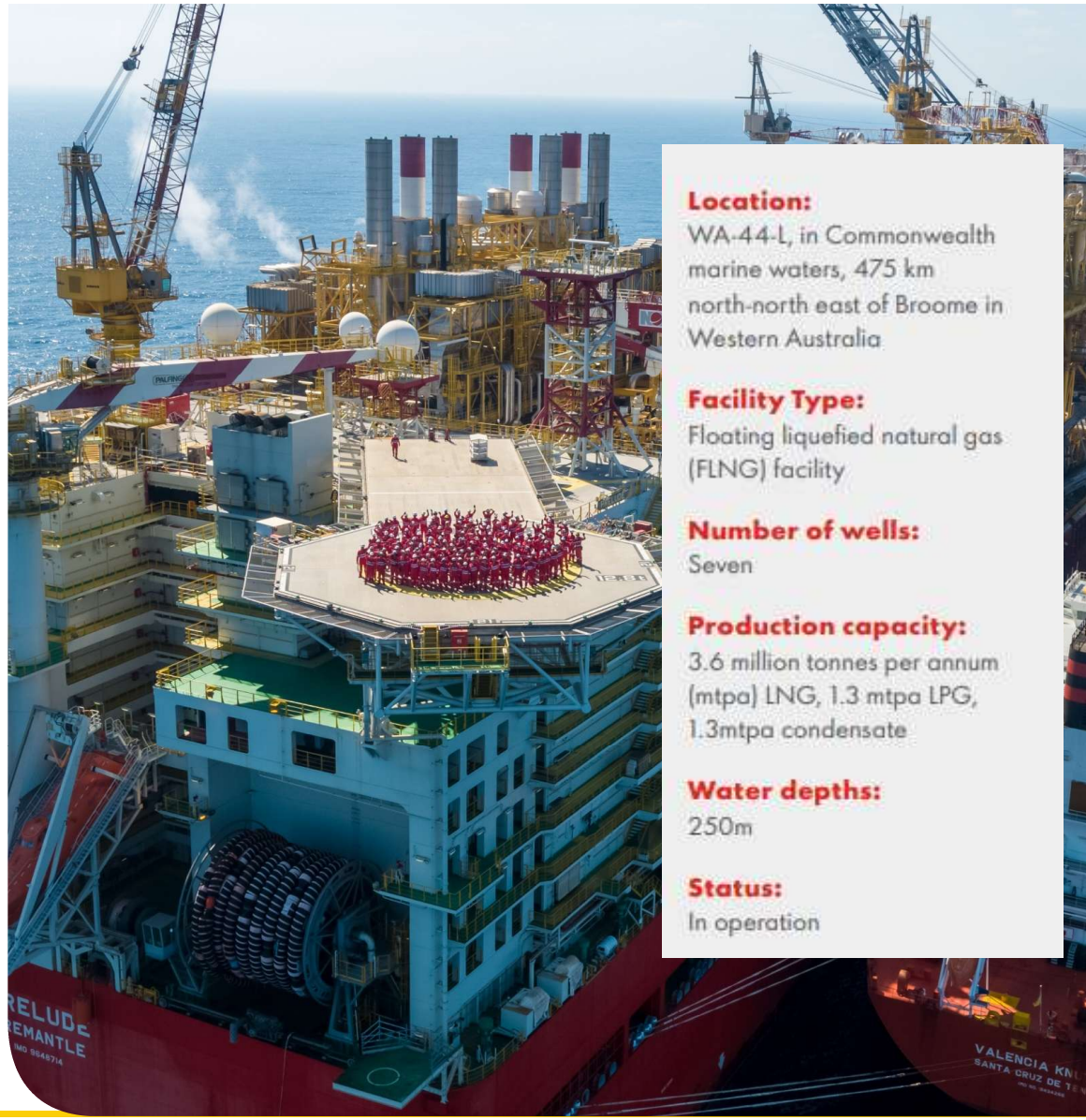
120 MW
SOLAR DEVELOPMENT IN COMMISSIONING

RESTRICTED

* By load, based on Shell Energy analysis of publicly available data
Prelude, QGC, Gorgon and North West Shelf MTPA values represent Shell share
Gorgon CCUS total from CCS system startup in August 2019 to May 2023

Prelude

- Prelude is a Floating Liquefied Natural Gas (FLNG) facility located 475km north-northeast of Broome, Western Australia, in the Browse Basin.
- Prelude is moored over the Prelude gas field in 250m water depth and more than 200km from the coastline.
- Prelude produces LNG, LPG and condensate.
- Prelude has an onshore supply base in Darwin.
- Shell Australia is the operator in joint venture with INPEX, KOGAS and OPIC.



Location:
WA-44-L, in Commonwealth marine waters, 475 km north-north east of Broome in Western Australia

Facility Type:
Floating liquefied natural gas (FLNG) facility

Number of wells:
Seven

Production capacity:
3.6 million tonnes per annum (mtpa) LNG, 1.3 mtpa LPG, 1.3mtpa condensate

Water depths:
250m

Status:
In operation

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Prelude Environment Plan (EP)

- Prelude has been operating since 2018, with the first Prelude Operations Environment Plan (EP) accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in 2016.
- The first 5-yearly revision - the current Prelude Operations EP - was accepted by NOPSEMA in 2021.
- Shell plans to submit the next 5-yearly revision of the Prelude EP to NOPSEMA in late 2025.
- This revision will cover the receipt and processing of Crux gas on Prelude.

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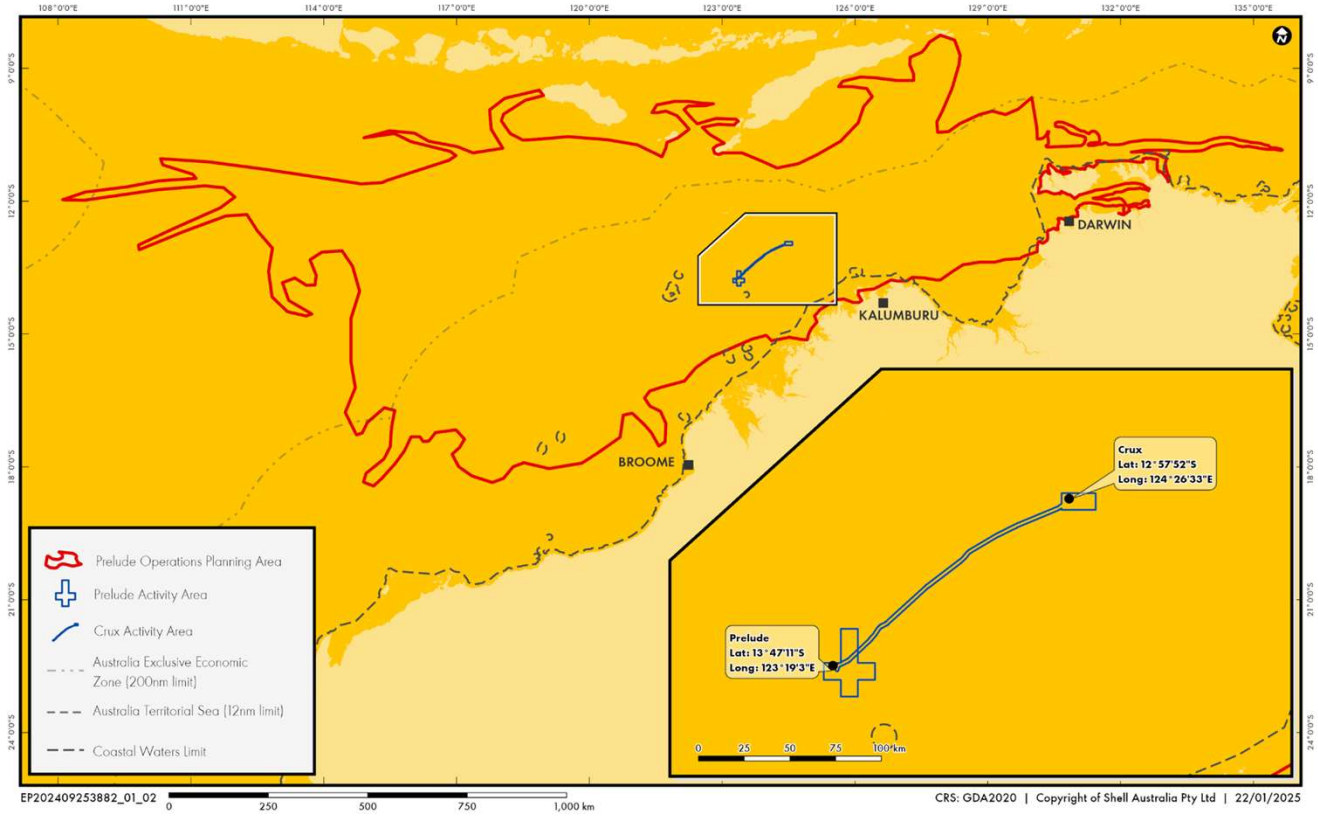
The Prelude Planning Area

- For Prelude Operations, Shell develops an Environment Plan which looks at the key risks of that stage, and the size and scale of any impacts
- This is represented using a Planning Area.
- It shows the maximum outside limit of hundreds of individual, possible spill incidents.
- This takes into account weather, waves, currents, and other conditions.



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Browse Regional Oil Pollution Emergency Plan (BROPEP)

- Contains information on how Shell will respond in the event of an oilspill.
- It documents Shell's Browse Basin regional spill response preparedness and first strike measures.
- Details capability, contracts and equipment.
- Shell has comprehensive capabilities and annual testing arrangements for BROPEP arrangements.

ScenarioC	Location Name	Latitude	Longitude	Depth (m)	Hazardous Liquid	Duration	Total Volume (m^3)
Loss of well control	Prelude Production Well	13°50"22" S	123°19"35.8" E	237	Well fluid	80 days	254,400
Loss of containment during product offloading (collision)	Prelude FLNG	13°47.2'S	123°19.0' E.	surface	Condensate	2 hours	42,000
Loss of containment of heavy fuel oil	Prelude FLNG	13°47.2'S	123°19.0' E.	surface	HFO	1 hour	1,000
Loss of containment of diesel	Prelude FLNG	13°47.2'S	123°19.0' E.	surface	Diesel	1 hour	750
Loss of containment of amine	Prelude FLNG	13°47.2'S	123°19.0' E.	surface	Amine	1 hour	1,000

Response strategies included are;

1. source control, including subsea dispersant application
2. monitoring (including operational and scientific monitoring (OSMP) arrangements)
3. protection of sensitive receptors
4. shoreline clean-up and SCAT
5. containment and recovery
6. surface chemical dispersants
7. oiled wildlife response

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Expected vs unexpected activities

Expected Activities

Known activities that result in physical impact to the environment and occur within close proximity to the activity area. Shell has processes to control the impact of these such as:

- Physical presence of infrastructure and vessels
- Seabed disturbance
- Artificial light emissions
- Underwater sound emissions
- Atmospheric emissions (including GHG emissions)
- **Utility discharges**
- **Produced water discharge**

.

Unexpected Events

Unexpected events are very rare. Shell has to be prepared for them, to ensure adequate controls such as:

- Fauna interactions
- Accidental release of waste and chemicals overboard
- Introduction of invasive marine species
- **Vessel collision resulting in diesel spill**
- **Loss of Well Control resulting in oil spill**
- **Pipeline rupture resulting in oil spill**

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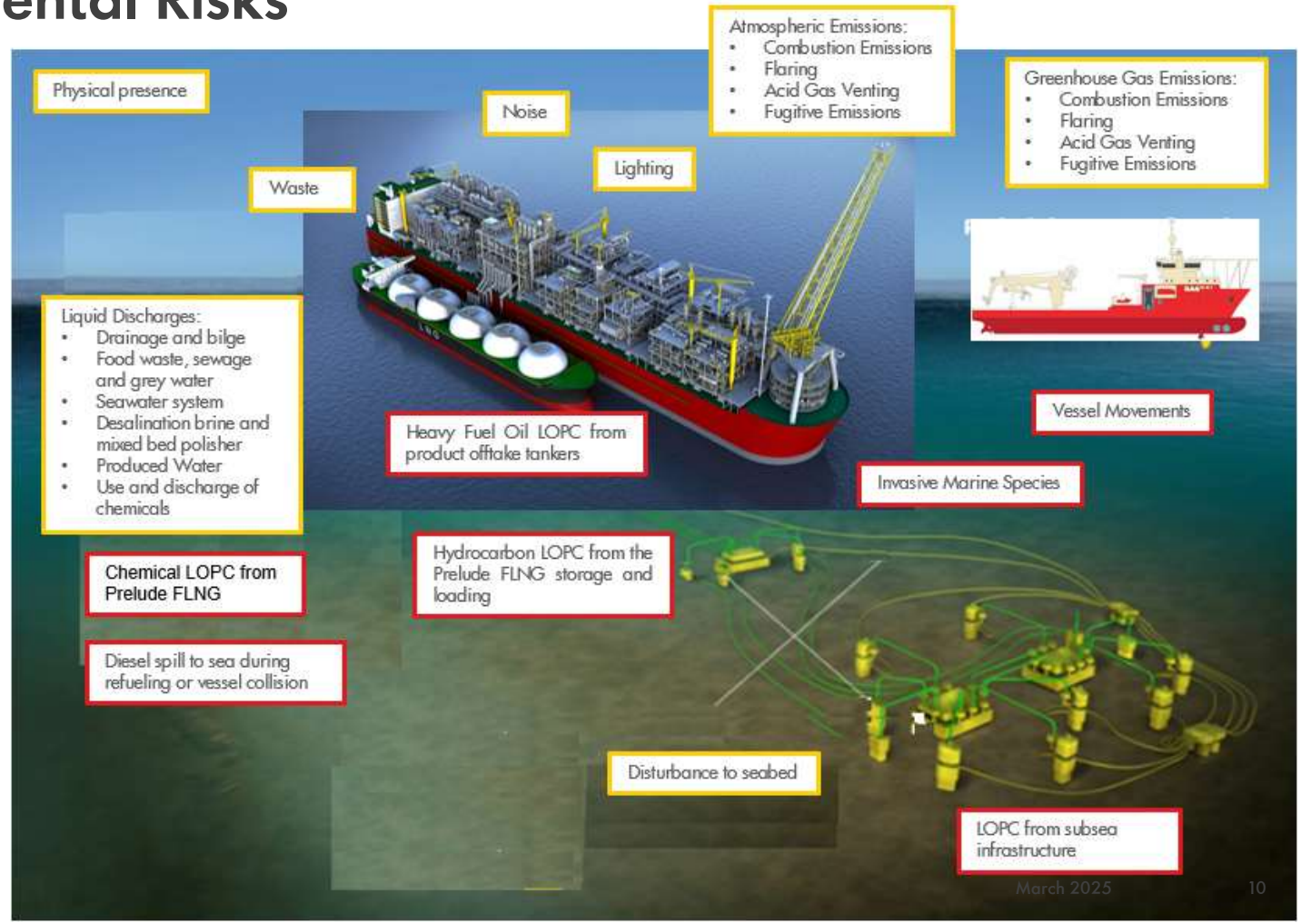
Our Top Environmental Risks

1. Greenhouse gas emissions
2. Liquid discharges
3. Unplanned spill events
4. Invasive Marine Species
5. Atmospheric emissions
6. Unplanned release of wastes
7. Vessel movements (unplanned interactions with marine fauna)



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Environment Panel

- A panel of subject matter experts has been established, who you can go to with questions or concerns
- You have access to the panel, with the costs incurred by Shell.
- It is anonymous - you can ask whatever you like from the panel.
- Shell will not see any of the information shared and any conversation is between you and the panel member.
- You are welcome to engage another environmental consultants for this purpose too and Shell will pay for these services to support you during the consultation process.

Sam Jarvis	0419 954 439	samantha@s2services.com.au
Richard Campbell	0488 253 618	richard.campbell@rpsgroup.com.au
Ashlyn Miller	0422 550 871	Ashlyn.Miller@xodusgroup.com

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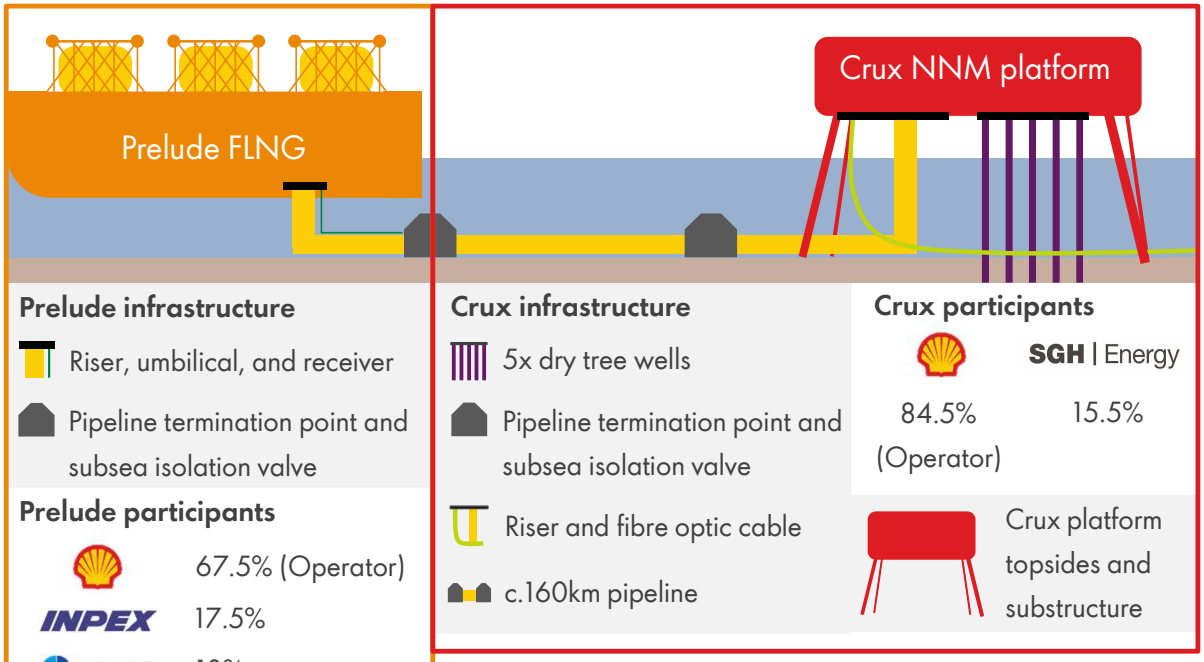
Prelude and Crux

Crux will leverage Prelude FLNG's existing infrastructure to its fullest extent to maximise capital efficiency and deliverability

Crux project boundary and key infrastructure under development



Prelude infrastructure

- Riser, umbilical, and receiver
- Pipeline termination point and subsea isolation valve

Prelude participants

Shell	67.5% (Operator)
INPEX	17.5%
KOGAS	10%
CPC Corporation, Taiwan	5%

Crux infrastructure

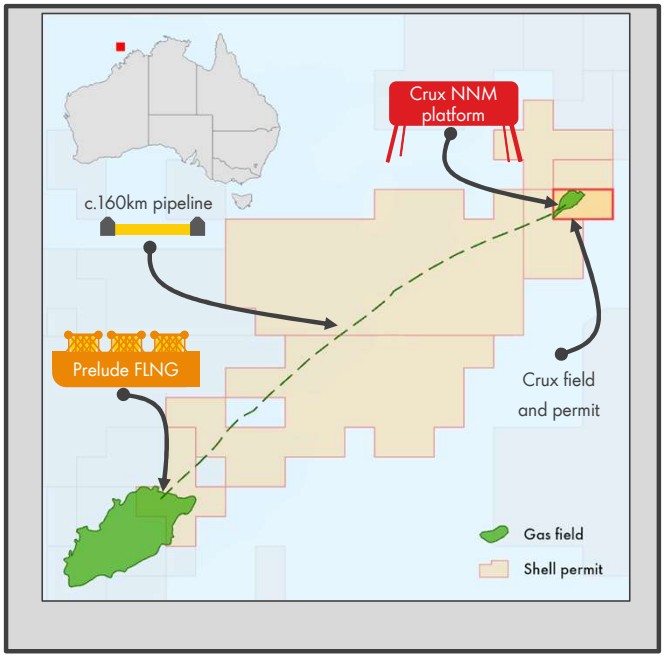
- 5x dry tree wells
- Pipeline termination point and subsea isolation valve
- Riser and fibre optic cable
- c.160km pipeline

Crux participants

Shell	SGH | Energy
84.5% (Operator)	15.5%

- Crux platform topsides and substructure

Crux field overview



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Crux – Project update

- Drilling campaign completed early 2025.
- Crux Installation and Cold Commissioning Environment Plan accepted in March 2025.
- The Crux Completions, Commissioning, Start-up and Operations Environment Plans.
- Next planned activities include:
  - installation of the Crux export pipeline connecting the Crux platform to the Prelude FLNG facility
  - installation of the Crux substructure and Topsides.

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Spend in the NT

- Approximately $60 Million spent in 2024 by Shell and main contractors in the Northern Territory and $48 million in 2023
- Examples of procurement scopes that have been previously available with Prelude FLNG include fabrication, piping materials, parts and consumables, tools, valves and fittings and welding consumables

Delivered through some of these contractors within the Shell Prelude FLNG Supply Chain:

- Wood Australia
- Amcor Excavations
- Western Downs Civil
- Well Data Pty Ltd
- Monadelphous Engineering
- Mitchell Water Australia
- RUSCA Environmental Solutions

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Where to from here?

- Ask questions of the Environment Panel
- Ask questions of us, Shell
- Are there others we should consult?

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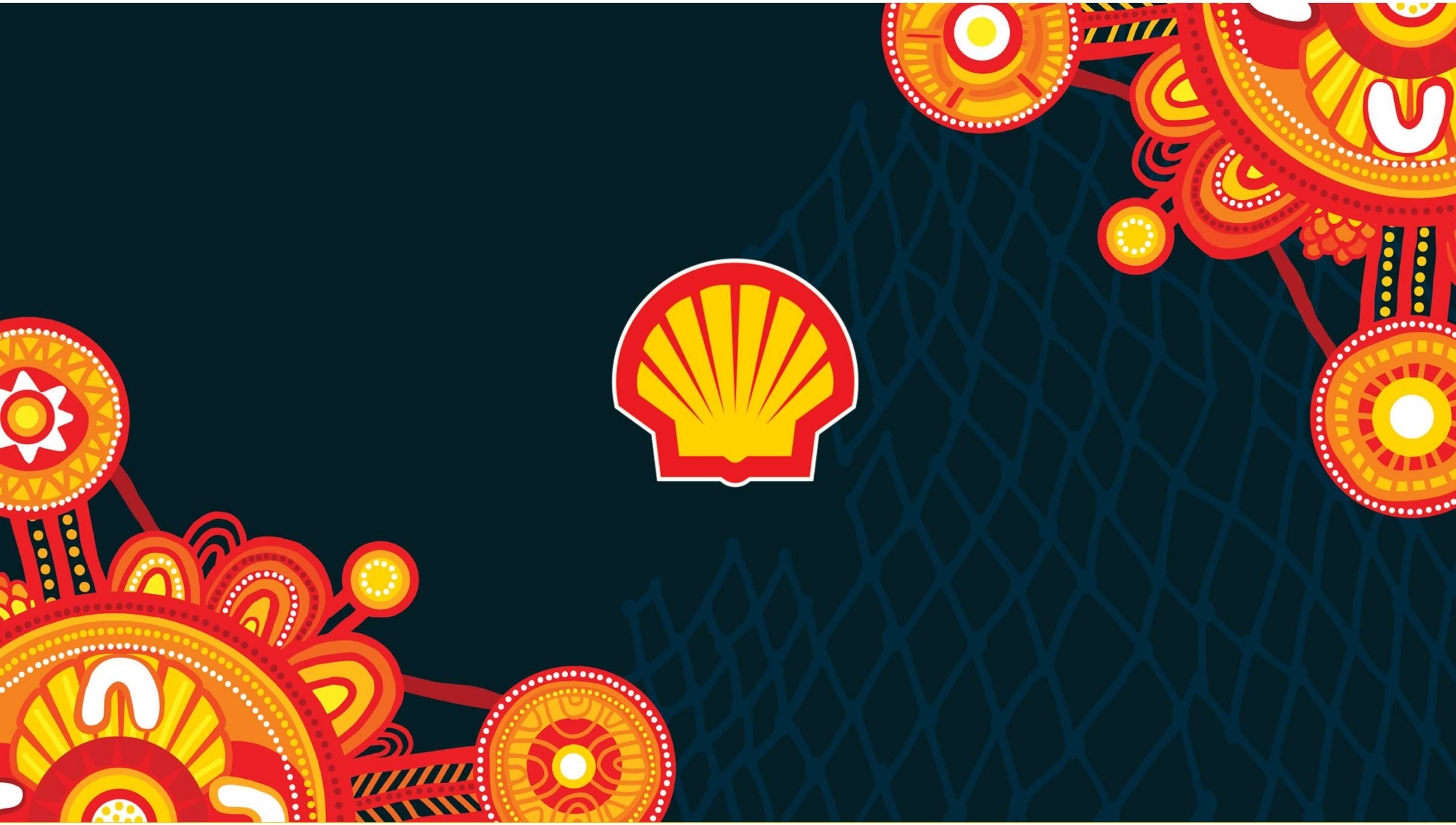

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Social Investment in the NT

Shell is committed to working with local communities to deliver a better future

Prelude to the Future delivered by GTNT

- Over the past 6 years, 121 people gained trade qualifications and experience in areas of skill shortage, with 104 (85.9%) gaining employment.
- A further 16 people placed in employment to commence their trade qualification in 2024.

Indigenous Business support program, delivered by Indigenous Business Network NT

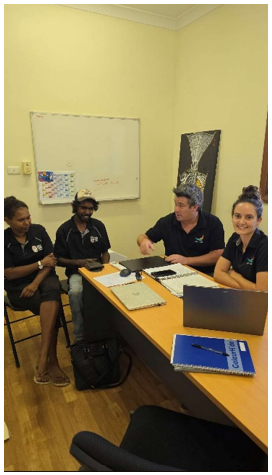
- Provides business support and growth services to Indigenous and Traditional Owner businesses in the NT.
- The service has supported 155 Indigenous businesses in the NT over the last 2 years.

Shell Indigenous Scholarships Program, delivered by MADALAH

- New program available to Traditional Owner language groups relevant to Shell's operational footprint. Supports Traditional Owners to gain qualifications for jobs through cert IV and above tertiary study.
- Provides scholarships up to $10k per annum and wrap up support to help them complete their studies successfully.
- 17 Indigenous people have commenced scholarships in 2025.

Community Grants Coordinator, delivered by Morrgul:

Provides business advisory, coaching training and support services to local and Indigenous businesses across Broome and the Kimberley to help them grow and create jobs.



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Our Top 3 Environmental Risks

Liquid discharges

- Continuously improve effluent water quality
- Only discharges authorised under the Environment Plan are permitted

Unplanned spill events

- Prevent spills and leaks

Greenhouse gas emissions

- Improve energy efficiency and minimise hydrocarbon fuel combustion
- Avoid flaring, venting and leaks of hydrocarbons

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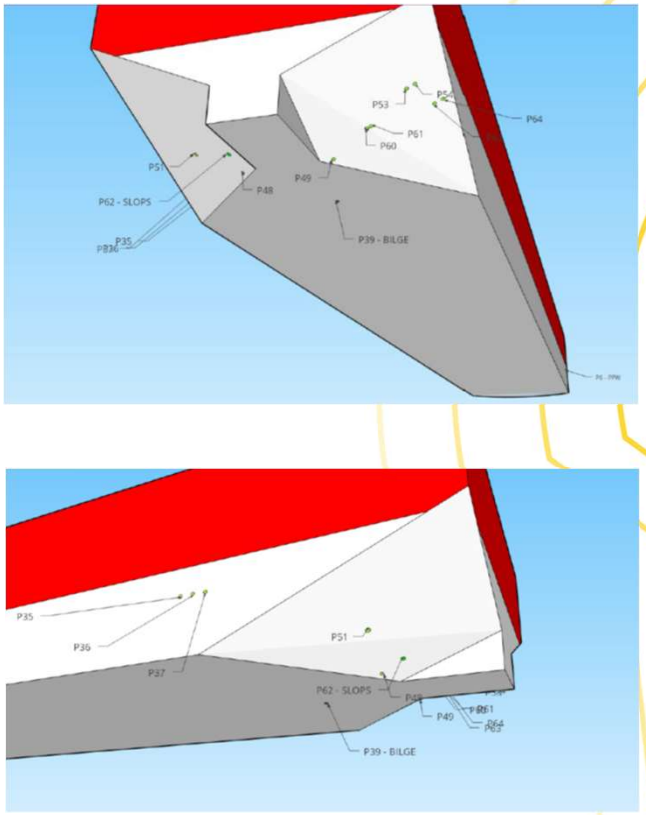
Liquid Discharges

There are several activities on Prelude that result in the discharge of liquid waste streams to the marine environment. These include:

- Drainage and bilge effluent
- Food waste, greywater and sewage
- Cooling Water (CW)
- Desalination brine, boiler blowdown and Mixed Bed Polisher (MBP) Effluent
- Produced Water (PW)
- Use and release of chemicals in ad-hoc discharges.

Note: unplanned spills, e.g. of chemicals or hydrocarbons, are considered separately



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Prelude Produced Water Management

- Prelude uses best available technology for offshore treatment (Macro Porous Polymer Extraction (MPPE) Package) in order to meet global and local standards for produced water discharge.
- The discharge limit for dispersed oil is a 24-hour average of 30 mg/L. Should this limit be exceeded, the water is manually diverted inboard for reprocessing.
- The produced water treatment system on Prelude is designed for a maximum 165 m3/hr discharge capacity.
- Oil in water is monitored using an online analyser.
- Produced water sample testing includes:
  - chemical characterisation
  - whole effluent ecotoxicological testing.
  - well understood discharge. Residual impacts from produced water are predicted to be slight (localised).

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The purpose of consultation

To give **relevant persons** an opportunity to provide input into:

- Shell's understanding of the existing environment which may be affected by proposed activities, including the cultural features of that environment;
- how Shell's activities might impact the existing environment including its cultural features; and
- how controls and mitigation measures may be adopted to protect what is important to you.

We want to hear from you if:

- your functions, interests, or activities, may be affected by the activities, risks and impacts described in the Environment Plan
- if you have cultural heritage interests or
- if you know someone else who may be affected.

We would like to know of other people or organisations who you think may be relevant for these activities too.

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Protecting and respecting land and sea country

Shell has done research to improve our understanding about what is important to Indigenous people in the Prelude planning area.

We used Healthy Country plans, Native Title Determinations, Indigenous Land Use Agreements, Indigenous Protected Areas, Cultural Heritage Surveys and Assessments, heritage site registration and talking directly with Indigenous groups.

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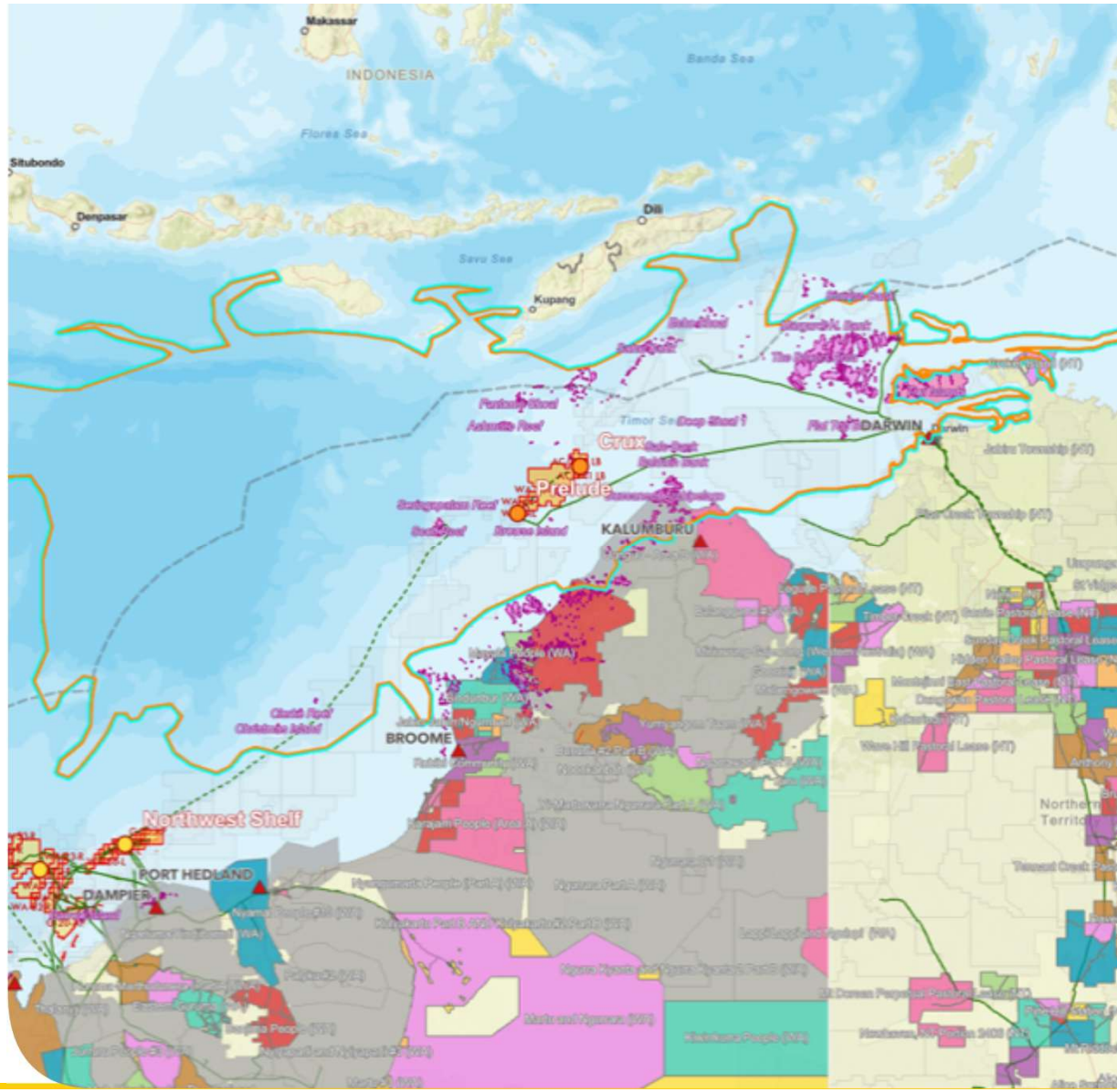
Underwater Cultural Heritage

- We've looked at WA and NT databases for registered sites - there are no sites currently registered within the activity area.
- The Prelude operating area is below the historical seabed levels (below 130m sea level). It's very unlikely there is any cultural heritage that far out to sea – the area was never above sea levels when human occupation existed.
- Further work mapping is being done on what tangible underwater cultural heritage could remain in the larger planning area.

What we don't know

- Specific cultural features and values of your country?
- Any concerns for particular areas and sites that may exist for each different Traditional Owner groups?
- What you think of our current management methods?



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6.00 Prelude Animation

Prelude consultation video - YouTube

Prelude Animation Transcript

Section 1: Prelude

- Located around 475km north-northeast of Broome,
- Shell's Floating Liquefied Natural Gas facility, called Prelude, is operational.
- The facility extracts, processes, liquefies and stores natural gas at sea
- It also removes things like CO2 as part of this process

- Prelude is an important part of Shell's natural gas portfolio.
- At 488m long and 74m wide Prelude will be moored in the field for its operational life.
- The facility is free to rotate around a fixed point, called the turret,
- which is anchored to the seabed by large chains and mooring piles.
- Flexible pipelines connect Prelude to a network of equipment deep beneath the sea.
- This subsea network controls the flow of gas into the facility.
- Once the gas arrives at Prelude, it is processed and chilled to -162°C
- which liquefies it and allows it to be stored in large tanks on the facility ready for export.
- The chilled gas is offloaded to carriers through pipes
- on special loading arms at the side of Prelude.
- Liquid condensate is offloaded to tankers through a floating hose at the rear.
- Once transferred to carriers the gas is shipped to customers around the world.

Section 2: Crux

- To provide future gas supply for Prelude, Shell is developing the nearby Crux field.
- The Crux project features a Not Normally Manned platform
- with five production wells, minimal processing facilities and utility systems.
- The platform will be operated remotely
- requiring only periodic maintenance visits,
- significantly reducing the operational safety exposure of staff.
- A 26" export pipeline, approximately 160km long,
- will connect the Crux project to Prelude along the seabed.

Section 3: Environmental Approvals

- Before Shell begins substantial work on major projects or existing facilities,
- the regulatory, environmental and social impacts are assessed,
- alongside commercial and technical considerations.
- Shell is preparing the 5-yearly revision for its Prelude Environment Plan
- for submission to NOPSEMA, the regulator.
- This Environment Plan outlines all the environmental impacts and risks of an activity,
- and how these will be managed and minimised.
- This includes things like emissions, noise, light as well as liquid and chemical discharges.
- Shell is consulting with relevant community members
- who have functions, interests or activities that may be affected,

- which is an important part of these approvals.
- For more information on these plans, visit shell.com.au/prelude

[RP Name]
Shell Australia

[Date]

Shell Australia respectfully acknowledges the many Traditional Owner groups of the lands and waters on which we operate and pay our respect to the Elders past, present and emerging.

Agenda

1. Background on Shell
2. Prelude Environment Plan
3. Crux Project Update
4. Social Investment

- ask questions at any time

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Shell in Australia

Shell's integrated energy solutions portfolio in Australia

PRELUDE

3.6 MTPA
LNG
LIQUIDS & CONDENSATE CAPACITY

QGC

8.5 MTPA
LIQUIDS & CONDENSATE CAPACITY

Non-Operated Ventures

2.8 MTPA
NORTH WEST SHELF

3.9 MTPA
GORGON

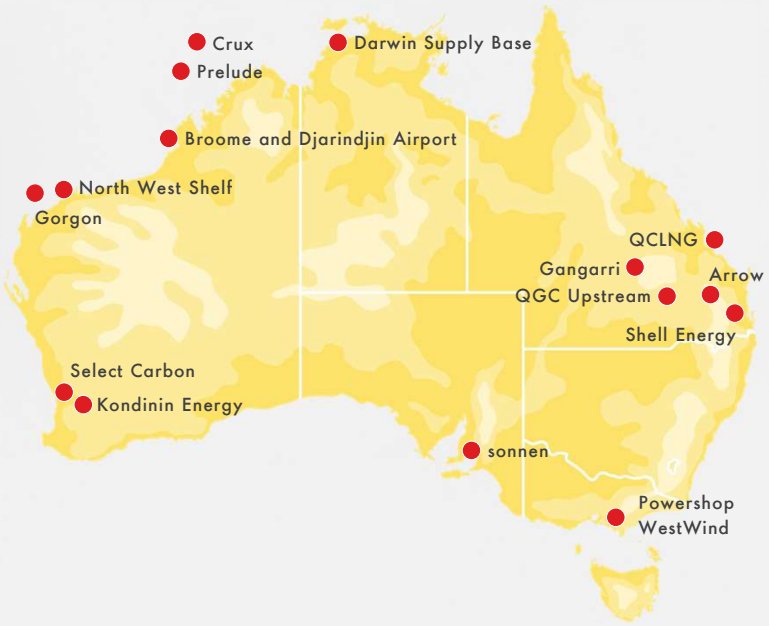
MORE THAN
8M TONNES
C02 INJECTED BY GORGON CCUS TO DATE

KONDININ ENERGY

370 MW
OF DEVELOPMENT ACROSS WIND, SOLAR AND BATTERY ENERGY STORAGE SYSTEM ASSETS

SelectCarbon

MILLIONS OF HECTARES
OF CARBON SEQUESTRATION PROJECTS ACROSS AUSTRALIA



POWERSHOP

200K+
RESIDENTIAL AND SMALL BUSINESS GAS AND ELECTRICITY CUSTOMERS

WestWind ENERGY

670 MW
WIND PROJECTS DELIVERED

arrow energy

27 YEAR
GAS SUPPLY AGREEMENT WITH QCLNG

Shell ENERGY

2nd LARGEST*
ELECTRICITY PROVIDER TO C&I BUSINESSES

sonnen

80%
YEARLY HOME ENERGY NEEDS MET WITH PV + sonnenBATTARIE

GANGARRI

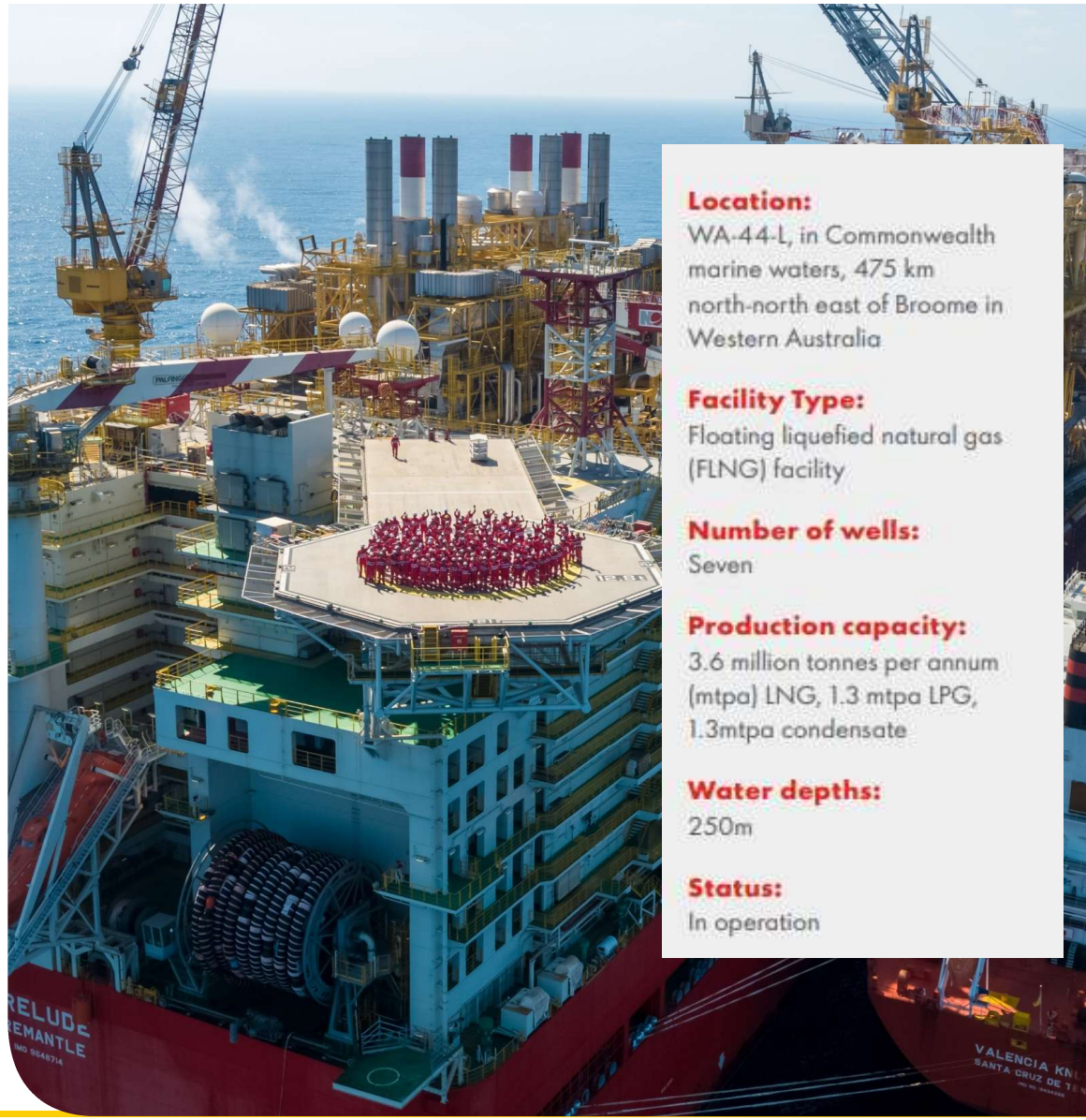
120 MW
SOLAR DEVELOPMENT IN COMMISSIONING

RESTRICTED

* By load, based on Shell Energy analysis of publicly available data
Prelude, QGC, Gorgon and North West Shelf MTPA values represent Shell share
Gorgon CCUS total from CCS system startup in August 2019 to May 2023

Prelude

- Prelude is a Floating Liquefied Natural Gas (FLNG) facility located 475km north-northeast of Broome, Western Australia, in the Browse Basin.
- Prelude is moored over the Prelude gas field in 250m water depth and more than 200km from the coastline.
- Prelude produces LNG, LPG and condensate.
- Prelude has an onshore supply base in Darwin.
- Shell Australia is the operator in joint venture with INPEX, KOGAS and OPIC.



Location:
WA-44-L, in Commonwealth marine waters, 475 km north-north east of Broome in Western Australia

Facility Type:
Floating liquefied natural gas (FLNG) facility

Number of wells:
Seven

Production capacity:
3.6 million tonnes per annum (mtpa) LNG, 1.3 mtpa LPG, 1.3mtpa condensate

Water depths:
250m

Status:
In operation

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Prelude Environment Plan (EP)

- Prelude has been operating since 2018, with the first Prelude Operations Environment Plan (EP) accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in 2016.
- The first 5-yearly revision - the current Prelude Operations EP - was accepted by NOPSEMA in 2021.
- Shell plans to submit the next 5-yearly revision of the Prelude EP to NOPSEMA in late 2025.
- This revision will cover the receipt and processing of Crux gas on Prelude.

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The purpose of consultation

To give **relevant persons** an opportunity to provide input into:

- Shell's understanding of the existing environment which may be affected by proposed activities, including the cultural features of that environment;
- how Shell's activities might impact the existing environment including its cultural features; and
- how controls and mitigation measures may be adopted to protect what is important to you.

We want to hear from you if:

- your functions, interests, or activities, may be affected by the activities, risks and impacts described in the Environment Plan
- if you have cultural heritage interests or
- if you know someone else who may be affected.

We would like to know of other people or organisations who you think may be relevant for these activities too.

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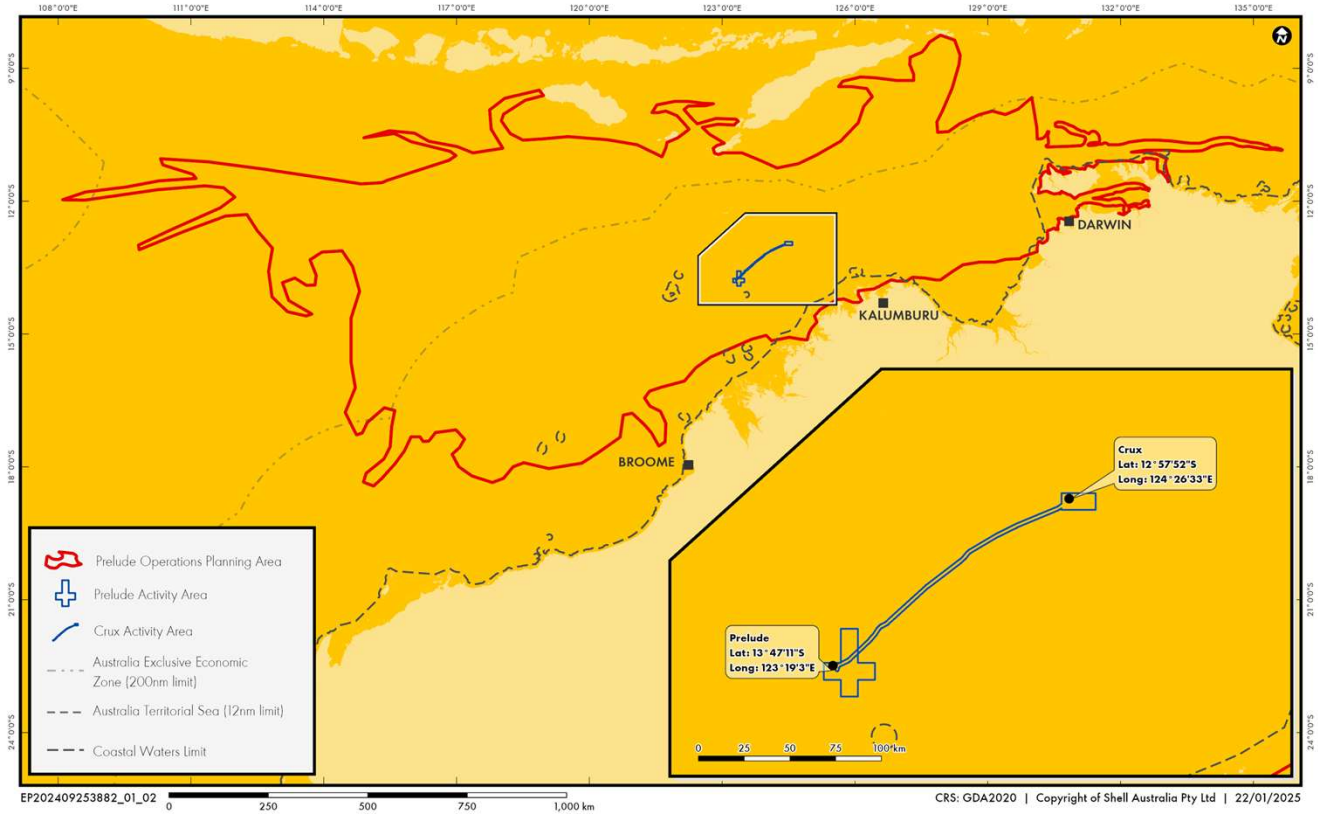
The Prelude Planning Area

- For Prelude Operations, Shell develops an Environment Plan which looks at the key risks of that stage, and the size and scale of any impacts
- This is represented using a Planning Area.
- It shows the maximum outside limit of hundreds of individual, possible spill incidents.
- This takes into account weather, waves, currents, and other conditions.



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Browse Regional Oil Pollution Emergency Plan (BROPEP)

- BROPEP is Shell's regional spill contingency plan or OPEP.
- It documents Shell's Browse Basin regional spill response preparedness and first strike measures.
- Accepted by NOPSEMA under Drilling EP and will be referred to for both the Prelude and Crux EPs.
- Shell has comprehensive capabilities and annual testing arrangements for BROPEP arrangements.
- Regional exercise occurred Sept 2024 with over 200 personnel and regulators participating.

Response strategies included are;

1. source control, including subsea dispersant application
2. monitoring (including operational and scientific monitoring (OSMP) arrangements)
3. protection of sensitive receptors
4. shoreline clean-up and SCAT
5. containment and recovery
6. surface chemical dispersants
7. oiled wildlife response

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Expected vs unexpected activities

Expected Activities

Known activities that result in physical impact to the environment and occur within close proximity to the activity area. Shell has processes to control the impact of these such as:

- Physical presence of infrastructure and vessels
- Seabed disturbance
- Artificial light emissions
- Underwater sound emissions
- Atmospheric emissions (including GHG emissions)
- **Utility discharges**
- **Produced water discharge**

.

Unexpected Events

Unexpected events are very rare. Shell has to be prepared for them, to ensure adequate controls such as:

- Fauna interactions
- Accidental release of waste and chemicals overboard
- Introduction of invasive marine species
- **Vessel collision resulting in diesel spill**
- **Loss of Well Control resulting in oil spill**
- **Pipeline rupture resulting in oil spill**

WS1

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Slide 10

WS1 Added chemicals

Wiegele, Tim H SDA-IUL/F/P/SE, 2025-03-21T01:43:32.458

Protecting and respecting land and sea country

Shell has done research to improve our understanding about what is important to Indigenous people in the Prelude planning area.

We used Healthy Country plans, Native Title Determinations, Indigenous Land Use Agreements, Indigenous Protected Areas, Cultural Heritage Surveys and Assessments, heritage site registration and talking directly with Indigenous groups.

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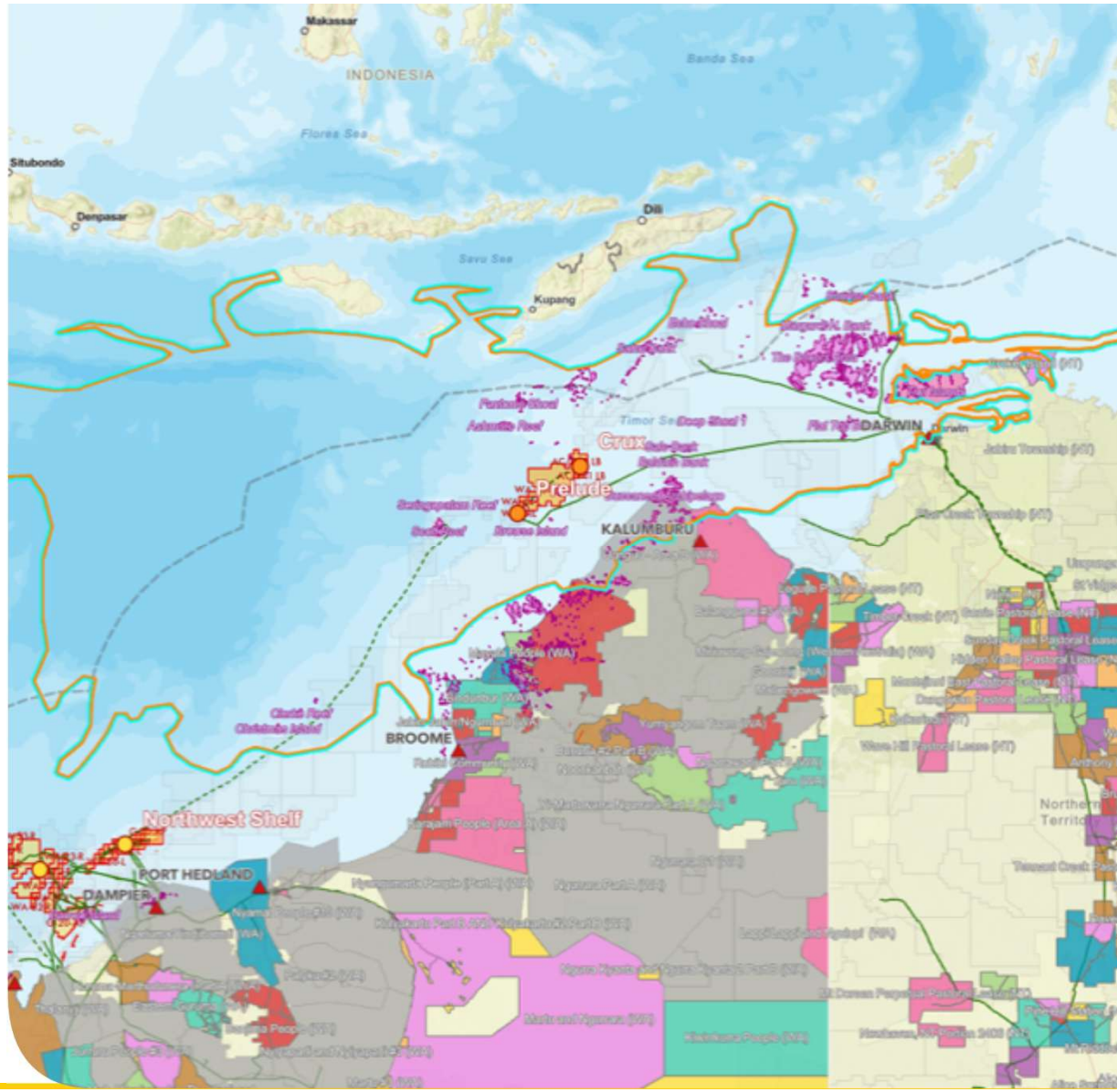
Underwater Cultural Heritage

- We've looked at WA and NT databases for registered sites - there are no sites currently registered within the activity area.
- The Prelude operating area is below the historical seabed levels (below 130m sea level). It's very unlikely there is any cultural heritage that far out to sea – the area was never above sea levels when human occupation existed.
- Further work mapping is being done on what tangible underwater cultural heritage could remain in the larger planning

KM1

What we don't know

- Specific cultural features and values of your country?
- Any concerns for particular areas and sites that may exist for each different Traditional Owner groups?
- What you think of our current management methods?



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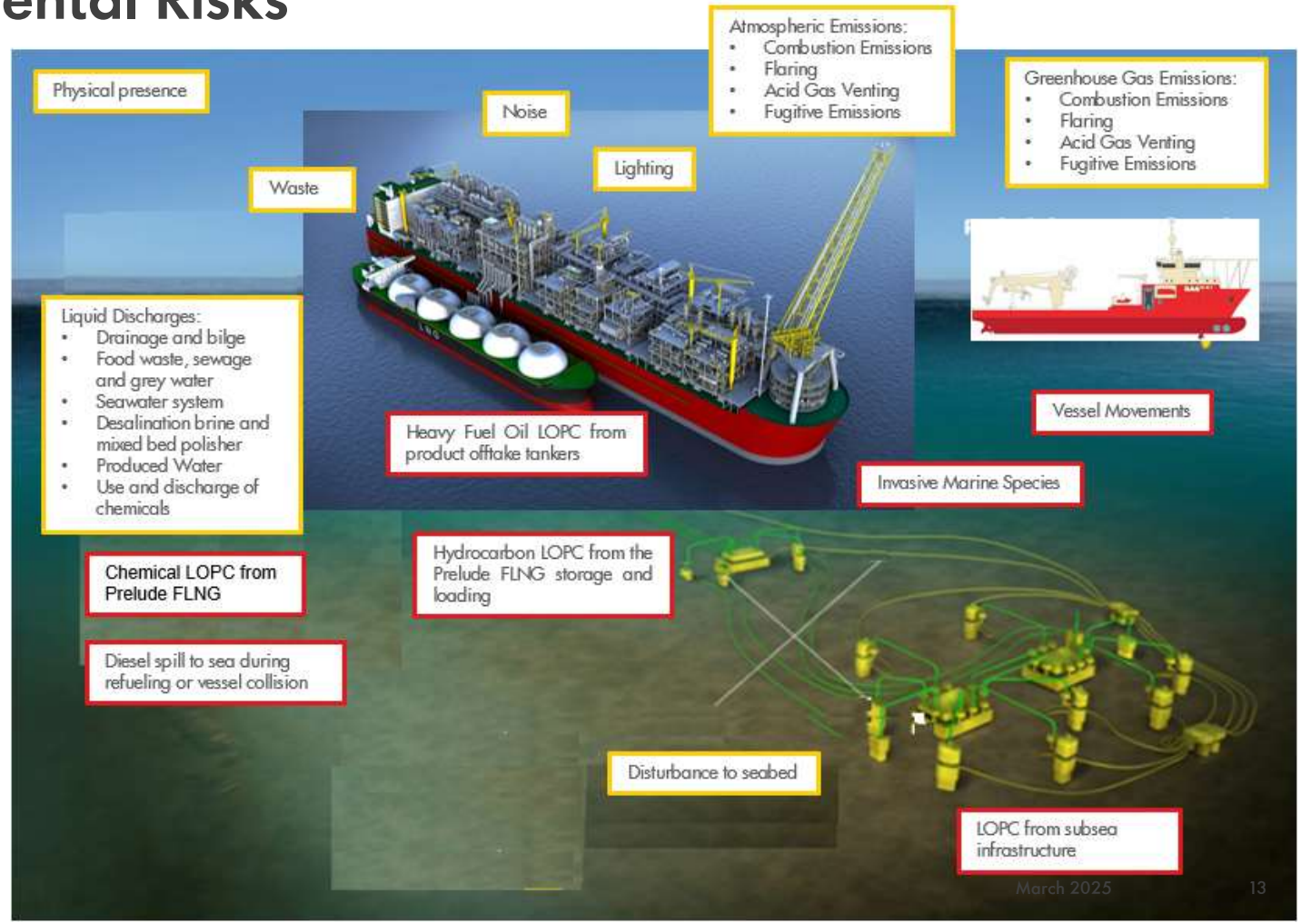
Slide 12

KM1 Still accurate?
Murphy, Kate L SDA-CRAA/ZE, 2025-03-20T08:42:53.498

Our Top Environmental Risks

1. Greenhouse gas emissions
2. Liquid discharges
3. Unplanned spill events
4. Invasive Marine Species
5. Atmospheric emissions
6. Unplanned release of wastes
7. Vessel movements (unplanned interactions with marine fauna)



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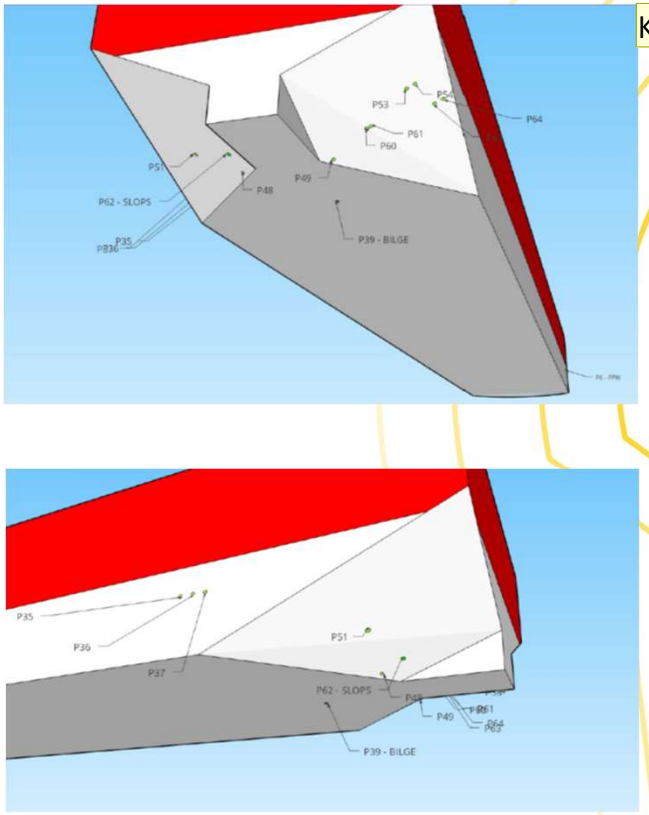
Liquid Discharges

There are several activities on Prelude that result in the discharge of liquid waste streams to the marine environment. These include:

- Drainage and bilge effluent
- Food waste, greywater and sewage
- Cooling Water (CW)
- Desalination brine, boiler blowdown and Mixed Bed Polisher (MBP) Effluent
- Produced Water (PW)
- Use and release of chemicals in ad-hoc discharges.

Note: unplanned spills, e.g. of chemicals or hydrocarbons, are considered separately



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Slide 14

KM1 Do we have any better images for this slide? These seem a bit abstract.
Murphy, Kate L SDA-CRAA/ZE, 2025-03-20T07:27:21.940

Prelude Produced Water Management

- Prelude uses best available technology for offshore treatment (Macro Porous Polymer Extraction (MPPE) Package) in order to meet global and local standards for produced water discharge.
- The discharge limit for dispersed oil is a 24-hour average of 30 mg/L. Should this limit be exceeded, the water is manually diverted inboard for reprocessing.
- The produced water treatment system on Prelude is designed for a maximum 165 m3/hr discharge capacity.
- Oil in water is monitored using an online analyser.
- Produced water sample testing includes:
  - chemical characterisation
  - whole effluent ecotoxicological testing.
  - well understood discharge. Residual impacts from produced water are predicted to be slight (localised).

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Environment Panel

- A panel of subject matter experts has been established, who you can go to with questions or concerns
- You have access to the panel, with the costs incurred by Shell.
- It is anonymous - you can ask whatever you like from the panel.
- Shell will not see any of the information shared and any conversation is between you and the panel member.
- You are welcome to engage another environmental consultants for this purpose too and Shell will pay for these services to support you during the consultation process.

Sam Jarvis	0419 954 439	samantha@s2services.com.au
Richard Campbell	0488 253 618	richard.campbell@rpsgroup.com.au
Ashlyn Miller	0422 550 871	Ashlyn.Miller@xodusgroup.com

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Ongoing Consultation

- Shell has commitments for ongoing consultation under EP's accepted by NOPSEMA last year.
- Aims to better understand the cultural features and other environmental values
- This is intended to help improve environmental management on those activities we're doing now or will be starting soon e.g. Template installation completed January 2024 but also inform future EP's
- Improve oil spill preparedness using a pilot with a traditional owner group.
- Share learnings and consult on the Underwater Cultural Heritage scope Shell commissioned in 2023.

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Crux – Project update

- Drilling campaign completed early 2025.
- Crux Installation and Cold Commissioning Environment Plan accepted in March 2025.
- The Crux Completions, Commissioning, Start-up and Operations Environment Plans.
- Next planned activities include:
  - installation of the Crux export pipeline connecting the Crux platform to the Prelude FLNG facility
  - installation of the Crux substructure and Topsides.

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Social Investment in Shell Australia

- Some of the longer-term larger programs we support provide sustained benefits to both our business and communities.
- When we talk to communities where we operate, these areas came up regularly and have directed our investment in areas that align with our business
- We're taking a fresh look at our social investment strategy for our programs being delivered from 2026-2028.
- Typically, we look at 3-year programs in the above areas to build long term social outcomes in above areas across a region or community.

SUPPORTING STRONGER FIRST NATIONS

We respect Indigenous people's deep connection to the land where we work.

We want to support them in rebuilding their identity and shaping their future.

REGIONAL ECONOMIC DEVELOPMENT

A diverse local economy benefits everyone.

Shell wants to be just one part of a thriving economy and support the growth of other sectors alongside our own.

JOBS FOR THE FUTURE

Local communities want young people to have meaningful jobs.

To access jobs with Shell and many other employers in the future, young people will need strong science skills, and foundational skills and support to learn.

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Social Investment Overview

Bardi Jawi Oorany Rangers, Kimberley Land Council

Assists sustainable employment for women rangers and protects the environment and culture through traditional caring for country practices on the Dampier Peninsula

Warrmijala Murrgurlayi 'Rise up to Work', Nyamba Buru Yawuru

Provides cultural, social, training and placement support for Indigenous people to gain employment in Broome.

Deadly Sista Girlz, Waalitj Foundation

Deadly Sista Girlz supports high school attainment for Indigenous young people in Broome.

P242, Waalitj Foundation

P242 provides training and employment services for Indigenous people in Perth metro and Peel.

Kimberley Business Network, Broome Community, Commerce & Industry

Provides business advisory, coaching and support services to local and Indigenous businesses in Broome and Djarindjin to help them grow and create jobs.

Indigenous Business Support, Northern Territory Indigenous Business Network

Provides coaching and support to Indigenous businesses to help them grow in Darwin.

Prelude to the Future, Group Training Northern Territory

Provides accredited traineeships and apprenticeships, placing Territorians into employment in areas of skills shortage in Darwin.

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Social Investment in the Kimberley

Shell is committed to working with local communities to deliver a better future

Warrmijala Murrgurlayi
(rise up to work)
Nyamba Buru Yawuru

Provides cultural, social, training and placement support for Indigenous people to gain employment.

Bardi Jawi Oorany Rangers
Kimberley Land Council

Protecting the environment and culture on the Dampier Peninsula.

Provides pathways to sustainable employment for women rangers and protects the environment and culture through traditional caring for country practices

Deadly Sista Girlz
Waalitj Foundation

Provides support to female students to continue their education.

Deadly Sista Girlz supports high school attainment for Indigenous young people.

Kimberley Business Network
Broome Chamber

Provides business advisory, coaching training and support services to local and Indigenous businesses across Broome and the Kimberley to help them grow and create jobs.

Rangelands Conference at Gumaranganyjal Station

Rangers Natasha George And Viv Hunter-Orchid Propagating

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Social Investment Update

Indigenous Scholarships - West Program

Delivered by Madalah

- Commencing for 2025, Semester 1 intake. Aims to support Traditional Owners in Shell's operational footprint to undertake further study.
- The program will provide 10 FTE of tertiary scholarships per annum (VET and University qualifications). Participants will be provided with up to $10k pa for full time study and wrap-around support to enable the completion of their studies.

MADALAH
MAKING A DIFFERENCE AND LOOKING AHEAD

Community Grants Coordinator

Delivered by Morrgul

- Program will provide support and capacity building for groups to access funding outside of Shell.
- Prioritising Traditional Owner groups initially, moving to broader community after first stage.

Morrgul

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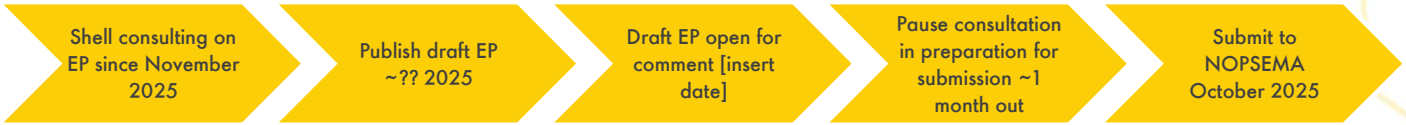
Where to from here?

- We want to stay in touch and develop stronger relationships
- Talk to your communities
- Ask questions of the Environment Panel
- Ask questions of us, Shell
- Are there others we should consult?



Information received during EP consultation must be documented in the EP when submitted to NOPSEMA.

Following acceptance, the EP will be published online.

Let us know if anything you've told us is sensitive and we will ensure it's not published.

KM2

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KM1

Slide 23

KM1 Cara or Tim can you advise when we might be in a position to publish the draft EP?
Murphy, Kate L SDA-CRAA/ZE, 2025-03-20T08:03:00.250

KM2 Suggest we remove this, as in reality that doesn't happen.
Murphy, Kate L SDA-CRAA/ZE, 2025-03-20T08:03:30.800

Q&A

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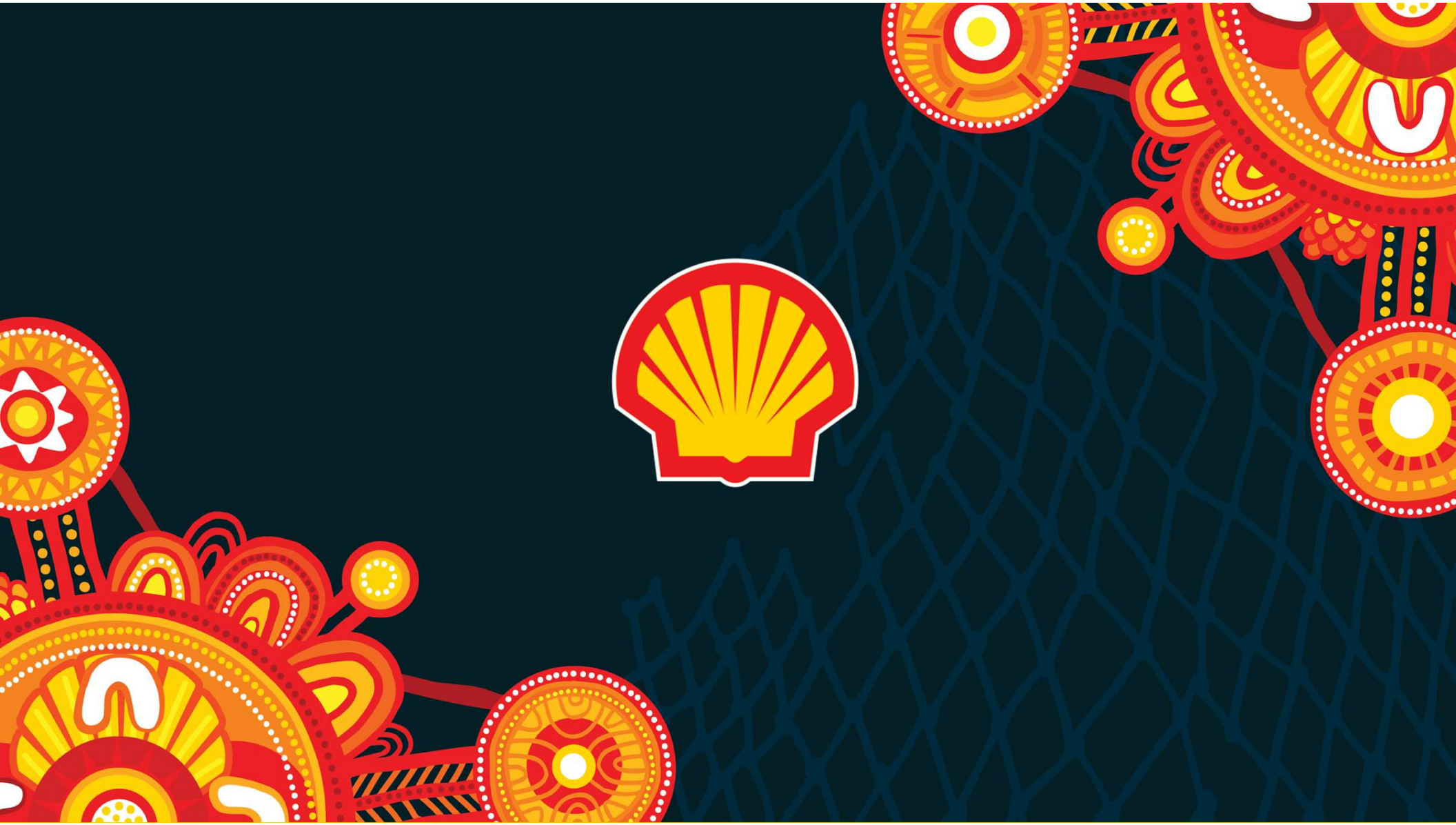

Why are we here today?

- We have a floating Liquefied Natural Gas facility off the Kimberley coast, called Prelude
- We are currently consulting with relevant persons on the five-yearly revision of the environment plan for Prelude
- To do this we need to make sure we:
  - Understand the environment we are developing in; and
  - Minimise any impact to the environment, including cultural heritage
- We've done a lot of research to understand the environment and our potential impact
- This information gets written in an Environment Plan and submitted to the regulator, NOPSEMA

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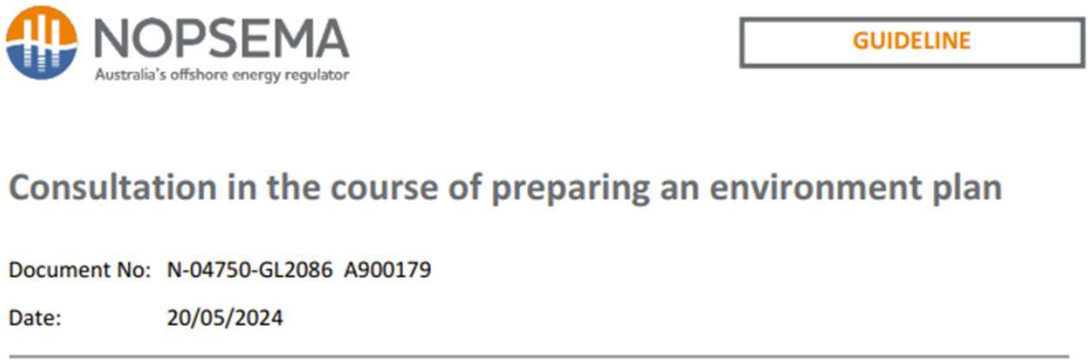
Offshore Petroleum Activities - Regulatory Context

Regulator: National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA)

Regulations:

- Offshore Petroleum Greenhouse Gas Storage (OPGGS) Act
- OPGGS (Environment) Regulations
  - Require Environment Plan (EP) accepted prior to commencing activities
  - Consultation with relevant persons an important part of the Environment Plan



nsultation in the course of
environment plan
.au)

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NOPSEMA | Australia's offshore energy regulator

Consultation on offshore petroleum environment plans

Information for the community

The National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) is Australia's independent expert regulator for health and safety, structural and well integrity, and environmental management for offshore petroleum and greenhouse gas storage activities in Commonwealth waters.

The protection and preservation of the marine environment is best achieved when there are opportunities for the community to participate in the environmental approvals process through consultation.

Who can participate?

Under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (the regulations) there are several ways the community can participate in the environmental approvals process for offshore petroleum activities in Commonwealth waters.

Public comment for new projects and exploration activities

Offshore project proposals (OPPs) for new offshore petroleum projects and environment plans for offshore petroleum exploration activities are subject to a mandatory public comment period. Public comment must be done before the OPP or environment plan is submitted to NOPSEMA for assessment. Further information about public comment can be found at nopsema.gov.au.

Relevant persons consultation

Titleholders must consult with a specific category of people or organisations referred to as 'relevant persons' while preparing an environment plan for any offshore petroleum activity. This consultation must be done before the environment plan is submitted to NOPSEMA.

Some categories of relevant persons are specified in the regulations, such as government departments, however the information in this brochure is for the category of relevant persons who are not specified but who have 'functions, interests or activities' that may be affected by the offshore activity.

Correspondence directly to the regulator (NOPSEMA)

You can send correspondence directly to NOPSEMA; however, this generally cannot be considered until after the environment plan has been submitted. It is always better to use the public comment and relevant persons consultation processes in the first instance.

What is 'relevant persons' consultation?

Consultation on offshore petroleum activities is a two-way process where information is shared between titleholders and relevant persons. It is a requirement for titleholders when preparing an environment plan and is an important part of good environmental management.

Consultation provides an opportunity for people or organisations who may be affected by an offshore petroleum activity to raise concerns, including objections or claims, about the potential impacts of the activity, to seek information about how they may be affected, and how the titleholder intends to manage the activity to ensure the associated impacts are as low as reasonably practicable and are acceptable.

Information provided by relevant persons in consultation may also help titleholders better understand the values and sensitivities of the environment and inform the evaluation of the potential impacts and risks associated with the activity and how to manage them appropriately.

Am I a relevant person?

You may be a relevant person if you or your organisation have functions, interests, or activities that may be affected by an offshore petroleum activity proposed under an environment plan being prepared or already underway under an environment plan being revised.

The terms 'functions' 'interests' and 'activities' should be read broadly. You do not have to have a legal or financial interest that may be affected by an offshore petroleum activity to be a relevant person.

Interests that may be affected can include things like cultural and spiritual connections to the sea or interests in the protection of specific marine species. However, to be a relevant person your interests should be more than a general interest in the environment and/or offshore petroleum activities.

If I am a representative body, can I consult on behalf of all my members?

The law recognises that interests may be held communally. In some cases, all members of a community may agree that their representative body can consult on their behalf. However, this may not always be the case. Representative bodies should inform titleholders whether or not they have the authority to consult with titleholders on behalf of all their members.

Representative bodies, such as peak bodies and prescribed body corporates, may be relevant persons in their own right. They may also be an initial point of contact for titleholders to seek information about who else they should approach for consultation.

It is the titleholder's responsibility to provide all members of a community who have a shared interest opportunities to participate in consultation. In some circumstances, representative bodies may offer to assist titleholders with this.

Do I have to participate?

If you are a relevant person, you have the right to be consulted by titleholders of offshore petroleum activities when they are preparing an environment plan to submit to NOPSEMA.

Titleholders have a duty to provide you an opportunity to be consulted, however there is no obligation on you to participate in consultation. If you do not wish to be consulted, you should advise titleholders of this when they first contact you.

Titleholders must make reasonable efforts to consult with relevant persons, but the regulations do not require them to get a response to their requests. If you want to participate in consultation but need more information or time then it is best to communicate this to titleholders when they contact you. If you do not respond, they might assume you do not wish to be consulted.

If you are an organisation or representative body that is regularly approached for consultation you may consider developing guidance outlining how and when you want to be consulted. You could also consider documenting your functions, interests and activities. Both measures may help with managing regular requests for consultation.

In some instances, the likelihood of you being affected by an activity is very low and/or the impact on your functions, interests or activities may be minor. For example, if you are only going to be affected by the activity in the very unlikely event of an oil spill you may wish to inform titleholders you only want to be consulted if a spill occurs as part of the requirement for ongoing consultation set out in the regulations.

What if I want to be consulted but the titleholder hasn't contacted me?

Titleholders have a duty to identify who may be a relevant person and provide them opportunities to participate in consultation. However, even with best endeavors, titleholders may miss people or organisations who may be relevant.

If you believe you are a relevant person and you want to be consulted on offshore petroleum activities, then you should contact titleholders directly and identify yourself as a relevant person.

If a titleholder refuses to consult with you, and you believe you are a relevant person, you can write to NOPSEMA. Once an environment plan is submitted to NOPSEMA, this information can be considered in the assessment of whether or not the titleholder has met the requirements for consultation.

It is always better to attempt to resolve issues with the titleholder in the first instance. Relevant persons consultation is carried out before an environment plan is submitted, so NOPSEMA is limited in its ability to require titleholders to consult with a particular person or organisation.

What is the process for consultation?

There is no detailed process set out for how consultation should be carried out, however there are requirements that must be met under the regulations. These include:

- That you are given sufficient information to make an informed assessment about whether you are likely to be affected by the activity, how you may be affected, and to raise any concerns, including objections or claims, about the potential impacts of the activity.
- That you are given a reasonable period of time to consider the information provided to you and give feedback to the titleholder on the potential impacts of the activity on your functions, interests or activities.

What constitutes sufficient information and a reasonable period of time depends on several factors including the nature of your functions, interests and activities. You should communicate as early as possible in consultation with titleholders about what information and how much time you may need so that they can consider, respond and address these in their planning.

The information provided to you should be in a form that is appropriate and readily accessible to you. Consultation is generally a two-way process where information is shared between titleholders and relevant persons rather than a one-way process of seeking feedback to a fact sheet or high-level information.

What if I don't have the resources to participate?

If you are a relevant person and you believe you have information that is important to the understanding of the potential impacts of an offshore petroleum activity or you want to raise concerns, including objections or claims, then you should discuss with the titleholder how you can participate in consultation.

This might include requesting information in a different format, asking for more time to consider information or help to understand the information to provide an informed response.

There is no requirement in the law for titleholders to pay the costs incurred by relevant persons to be consulted, however they may choose to provide assistance to relevant persons to ensure consultation is carried out efficiently and is robust. This is a matter between the titleholder and relevant persons.

How do I make sure my views are considered?

It is important to communicate clearly when participating in consultation with titleholders. You may provide information to titleholders that helps them understand the environment and raise specific concerns, objections or claims about the potential impacts of the activity or the way the titleholder proposes to manage the activity to ensure the associated impacts are as low as reasonably practicable and are acceptable.

The information you provide to a titleholder during consultation must be considered by that titleholder and addressed in their environment plan for NOPSEMA to consider in its assessment and decision-making.

NOPSEMA publishes environment plans on its website when they are submitted for public comment, for assessment and when they are approved. Relevant persons have the right to request that the information they have provided in consultation is not published and titleholders must ensure they communicate this right to relevant persons.

Relevant persons should be aware that while you are free to respond on any matter and raise any concern, this may not be able to be considered if it is outside the scope or purpose of the environment plan and approval process. Examples of issues that may not be considered under the regulations include statements of fundamental objection to offshore petroleum activities or information containing personal threats or profanities.

Do titleholders need my consent?

Titleholders are not required by law to obtain agreement or consent from relevant persons for their offshore petroleum activities to proceed; however, they are required to demonstrate in their environment plan how the concerns, objections or claims raised by relevant persons were considered and demonstrate that their response to that information was appropriate.

NOPSEMA's assessment and decision-making will consider if titleholders have adequately demonstrated in the environment plan that genuine consultation has taken place with relevant persons in accordance with regulations.

Do I need to respond to a request for consultation?

There is no obligation for relevant persons to respond to a request for consultation from a titleholder. However, if you are provided an opportunity to participate in consultation and you do not want to be consulted, or you only want to be consulted on specific offshore petroleum activities or environmental matters, then it is best that you communicate this to titleholders as soon as they contact you. If you do not respond to requests for consultation, titleholders may make many repeated attempts to contact you.

NOPSEMA can help you understand the requirements for consultation and how to effectively participate in the process. Please contact communications@nopsema.gov.au for assistance.

NOPSEMA | Australia's offshore energy regulator

Further information

For further information visit nopsema.gov.au or contact communications@nopsema.gov.au.

Key legislation

Offshore Petroleum and Greenhouse Gas Storage Act 2006
Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023
Environment Protection and Biodiversity Conservation Act 1999.

Contact details

p: +61 (08) 6188 8700
e: communications@nopsema.gov.au

Head office: Level 10, Alluvion Building
58 Mounts Bay Road, Perth WA 6000

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National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)

ABN 22 385 178 289

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Appendix B Summary of Consultation

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
Commonwealth and State Government Departments or Agencies						
Section 25(1) (a) of the OPGGS(E) Regulations						
8.	**Australian Border Force** (Maritime Border Command)	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Australian Border Force several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
4.	**Australian Communications and Media Authority (ACMA)**	**Email from Shell** 02 December 2024 *(initial email)* 11 March 2025 24 September 2025 *(final call)* **Email from ACMA** 02 December 2024	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 02 December 2024 from ACMA** ACMA confirmed that the Prelude Planning Area is not in the vicinity of any existing protection zones declared by the ACMA. There may be overlap with existing and proposed submarine cables and Shell was recommended to discuss its plans with the owners of nearby submarine cables (existing and proposed) to minimise potential risks to these cables, including. • Vocus' North-West Cable System • BW Digital's proposed Hawaiki Nui cable • Google's proposed Bosun cable • Inligo Network's proposed Asia Connect Cable system. ACMA also recommended Shell to contact the Australian Hydrographic Office (AHO). Advised that they do not require additional consultation on the EP. **Email on 11 March 2024 from Shell** Confirming contact had been made with the AHO.	No objections or claims received.	**Relevant matter to this EP** ACMA recommended Shell to contact the Australian Hydrographic Office (AHO), which Shell did as a relevant person for this EP. **Not relevant matter to this EP** ACMA advised Shell to discuss plans with a number of cable owners and contact the AHO. Shell has an existing relationship with Vocus, as they supply the fibre optic cable for Prelude. All the others are proposed cables and as Prelude is already installed and operating offshore, this was not seen as relevant to this EP.	ACMA have confirmed that no further consultation on this EP is required. Shell confirmed consultation with AHO had occurred. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
5.	**Australian Fisheries Management Authority (AFMA)**	**Email from Shell** 02 December 2024 *(initial email)* 13 December 2024 10 February 2025 25 February 2025 26 February 2025 05 March 2025 10 March 2025 24 September 2025 *(final call)* **Email from AFMA** 10 February 2025 26 February 2025 05 March 2025 13 March 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 13 December 2024 from Shell** Seeking latest contact details for Commonwealth Fisheries. **Email on 10 February 2025 from AFMA** AFMA advised Shell to contact DFAT regarding the MOU agreement between Australia and Indonesia. **Email on 10 February 2025 from Shell** Confirming that Shell has contacted DFAT. **Emails on 25, 26 February and 05, 10, 13 March 2025** Related to obtaining contact details of Commonwealth Fisheries. **Email on 24 September 2025 from Shell** Final call with link to draft EP.	No objections or claims received.	**Relevant matters to this EP** Shell requested assistance from AFMA with obtaining contact details from Commonwealth Fishers. AFMA advised Shell to reach out to DFAT related to MOU agreement, which Shell did as a relevant person for this EP.	Shell confirmed that DFAT had been contacted related to MOU agreement. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
2.	**Australian Hydrographic Office (AHO) – Department of Defence Operations Branch**	**Email from Shell** 02 December 2024 *(initial email)* 24 September 2025 *(final call)* 06 October 2025 **Email from AHO** 03 December 2024 25 September 2025 29 September 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 03 December 2024 from AHO** Acknowledgement email. **Email on 03 December 2024 from AHO** The AHO has no concerns with the activities proposed. Requested further updates once activity is due to begin. **Email on 24 September 2025 from Shell** Final email reminder, with link to draft EP. **Email on 25 September 2025 from AHO** Acknowledgement email. **Email on 29 September 2025 from AHO** The AHO has no concerns with the activities proposed. Requested further updates once activity is due to begin. **Email on 06 October 2025 from Shell** Confirming activity under this EP has already commenced, with Prelude operational. Notifications related to Crux activities have been incorporated into the relevant EPs associated with the Crux project as per previous consultation undertaken with the AHO.	No objections or claims received.	**Relevant matter to this EP** AHO requested updated once activity is due to begin. As Prelude is operational this is not relevant. However, Shell has added AHO to the notifications table.	AHO confirmed that they have no issues with the proposed activity. Shell has the AHO listed in the notifications table. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
3.	**Australian Maritime Safety Authority (AMSA)**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)* 20 October 2025 **Email from AMSA** 16 October 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 05 March 2025 from Shell** Reminder email. **Email on 24 September 2025 from Shell** Final email reminder, with link to draft EP. **Email on 16 October 2025 from AMSA** Advised of correct email address for consultation. Shared PDF showing the area of interest and outlining the heavy vessel traffic in this area. Reminded Shell of notification obligations and that Shell should contact the AHO. Outlined the appropriate light and shapes to reflect the nature of the operations and obligations to comply with international rules. **Email on 20 October 2025 from Shell** Shell acknowledged email address and other notification requirements, including contacting AHO and reinforcing Shell's commitment to adhere to relevant regulations.	No objections or claims received.	**Relevant matters to this EP** Raised relevant matters in regards pre-activity notifications and vessel navigation compliance requirements. Matters raised have been addressed as controls, EPS and/or notifications requirements stipulated in the EP. Reminded Shell to contact AHO and Shell confirmed that AHO are a relevant person for this EP.	Notification requirements have been incorporated into the EP. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
10.	**Clean Energy Regulator (CER)**	**Email from Shell** 02 December 2024 *(initial email)*	**Email on 02 December 2024 from Shell** Initial email with sufficient information.	No objections or claims received.	**Relevant matters to this EP**	Shell will continue to meet its reporting obligations under the NGER act.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		05 March 2025 *(reminder)* 24 September 2025 *(final call)* 06 October 2025 **Email from CER** 26 September 2025 29 September 2025	**Email on 05 March 2025 from Shell** Reminder email. **Email on 24 September 2025 from Shell** Final email reminder, with link to draft EP. **Email on 26 September 2025 from CER** Acknowledgement email. **Email on 29 September 2025 from CER** No specific issue with the plan, provided Shell continue to report on their obligations under the NGER act. **Email on 06 October 2025 from Shell** Shell confirmed we will continue to report on our obligations under the NGER Act		CER confirmed that they do not have any specific issues with what is set out in this Environment Plan. They noted Shell's reporting obligations under the NGER act, which Shell confirmed.	No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
13.	**Department of Climate Change, Energy, the Environment and Water (DCCEEW)** **Including Underwater Cultural Heritage.**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed DCCEEW several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
9.	**Department of Foreign Affairs (DFAT)**	**Email from Shell** 02 December 2024 *(initial email)* 10 February 2025 14 March 2025 24 September 2025 *(final call)* **Email from DFAT** 11 February 2025 14 March 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 10 February 2025 from Shell** Email sent to new contacts identified by AFMA. **Email on 11 February 2025 from DFAT** Recommended Shell contact the Indonesian Embassy in Canberra. **Email on 14 March 2025 from Shell** Following meeting with Indonesian Embassy, requesting contact details to give to the Embassy for DFAT. **Emails on 14 March 2025** Confirming contact details.	No objections or claims received.	**Relevant matter to this EP** DFAT recommended that Shell contact the Indonesian Embassy given the Prelude Planning Area extends into Indonesian waters, which Shell did.	Shell contacted the Indonesian Embassy, see records under RP 524. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
14.	**Department of Industry, Science, and Resources (DISR); including NOPTA**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed DISR several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
6.	**Director of National Parks (DNP)**	**Email from Shell** 02 December 2024 *(initial email)* **Email from DNP** 21 January 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 21 January 2025 from DNP** DNP confirmed there are no authorisation requirements from the DNP, and they do not require further notification of progress made in relation to this activity unless details	No objections or claims received.	Not applicable.	DNP confirmed that they have no issues with the proposed activity and do not require anything further unless the activity details change.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			regarding the activity change and result in an overlap with a marine park or new impact, or for emergency responses.			No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
22.	**Indigenous Land and Sea Corporation (ILSC)**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed ILSC several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
7.	**National Native Title Tribunal (NNTT)**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed NNTT several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
15.	**The Department of Agriculture Fisheries and Forestry's (DAFF)** **Including Marine Pest Risk Management**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed DAFF several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
Section 25(1)(b) of the OPGGS(E) Regulations						
24.	**Aboriginal Areas Protection Authority NT (AAPA)**	**Email from Shell** 11 March 2025 *(initial email)* 23 April 2025 (*reminder)* 24 September 2025 *(final call)* 17 October 2025 19 October 2025 **Email from AAPA** 25 September 2025 19 October 2025	**Email on 11 March 2025 from Shell** Initial email with sufficient information. **Email on 23 April 2025 from Shell** Reminder email. **Email on 24 September 2025 from Shell** Final call with link to draft EP. **Email on 25 September 2025 from AAPA** Explained AAPA's role to protect Aboriginal sacred sites in the NT through the issuing of Authority Certificates. **Email on 17 October 2025 from Shell** Confirming whether previous advice received on other EPs applied, specifically: • TEMC will be the NT controlling agency for oil spills which enter NT waters or impact NT shorelines and as incident controller and; • TEMC would also manage all aspects of acquisition & compliance with AAPA certificates, at the time of the spill event. **Email on 20 October 2025 from AAPA** Confirming that comments from previous EPs hasn't changed. **Email on 20 October 2025 from Shell**	No objections or claims received.	**Relevant matter to this EP** Shell confirmed with AAPA that previous advice still applied related to the TEMC approach to controlling oil spills in NT waters, and that TEMC would manage AAPA certificates at that time.	No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Thanking AAPA. **AAPA data received on 06 May 2026** **Worley Parsons managed this work for us – request was** for refreshed data for the Prelude Planning Area.			
26.	**Department of Biodiversity, Conservation and Attractions (DBCA)**	**Email from Shell** 02 December 2024 *(initial email)* 31 January 2025 24 September 2025 *(final call)* 05 November 2025 04 March 2026 **Email from DBCA** 16 January 2025 30 October 2025 04 March 2026	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 16 January 2025 from DBCA** DBCA requested additional information related to baseline studies for ecologically important areas within the Planning Area. **Email on 31 January 2025 from Shell** Shell responded to DBCAs request for further information. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP. **Email on 30 October 2025 from DBCA** Reiterating previous advice related to marine parks and biologically important areas for conservation. **Email on 05 November 2025 from Shell** Confirming comments have been addressed. **Email on 04 March 2026 from Shell** Shell emailed DBCA to seek clarification on notification requirements in the event of a hydrocarbon spill. Shell proposed that the DBCA notification requirement follow the same approach as DoT notifications. **Email on 04 March 2026 from DBCA** DBCA confirmed that the approach outlined was appropriate.	No objections or claims received.	**Relevant matters to this EP** DBCA requested information on baseline survey data related to ecologically important areas within the Planning Area. Shell confirmed that existing baseline data for the Browse region are described in the Browse Regional Oil Pollution Emergency Response Plan (BROPEP) and the Browse Regional Operational and Scientific Monitoring Bridging Implementation Plan (OSMP BIP). Shell shared the links to these documents with DBCA. DBCA requested notifications to DBCA and DOT should be in place in the event of an oil spill. Shell confirmed these notifications had been incorporated into this EP. These were further clarified in follow up correspondence. In developing its Environment Plan, DBCA recommended that Shell refer to the Commonwealth Department of Climate Change, Energy, the Environment and Water's National Light Pollution Guidelines for Wildlife as a best-practice industry standard for managing potential impacts of light pollution on marine fauna. Shell confirmed that all relevant national species and management plans relevant to the activity would be considered and applied. DBCA confirmed email address for notifications, which Shell noted.	Notification requirements have been incorporated into the EP. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
21.	**Department of Lands, Planning and Environment**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed Department of Lands, Planning and Environment several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
11.	**Department of Energy and Economic Diversification (DEED)**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed DEED several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
23.	**Department of Planning Lands and Heritage (DPLH)** including Heritage Council of WA and Aboriginal Cultural Heritage Committee	**Email from Shell** 02 December 2024 *(initial email)* 24 September 2025 *(final call)*	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 21 January 2025 from DPLH**	No objections or claims received.	Not applicable.	DPLH confirmed that they have no issues with the proposed activity. No additional measures have been adopted.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		Email from DPLH 21 January 2025	DLPH do not have any objection from a historic heritage perspective. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.			Accordingly, consultation in the course of preparation of this EP has been completed.
12.	**Department of Primary Industries and Region Development (DPIRD) – Fisheries Division**	**Email from Shell** 02 December 2024 *(initial email)* 17 December 2024 08 January 2025 09 January 2025 17 February 2025 19 February 2025 27 February 2025 04 March 2025 05 March 2025 21 May 2025 24 September 2025 *(final call)* **Email from DPIRD** 07 January 2025 08 January 2025 09 January 2025 17 February 2025 04 March 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 17 December 2024 from Shell** Requesting license holder details. **Email on 07 08 and 09 January 2025 from DPIRD** Related to obtaining license holder information. **Email on 17 February 2025 from DPIRD** Advice included: • Fishing activities in the area including the recommendation that Shell consult with peak fishing sector bodies in WA • Information on spill contingency plans including required notifications and specific strategies related to nursery and spawning grounds • Biosecurity – in particular related to biofouling • an update of legislation **Email on 17 February 2025 from Shell** Acknowledging receipt of email. **Email on 19 February 2025 from Shell** Shell provided a response to the points raised by DPIRD and incorporated advice into EP. **Email on 27 February, 04, 05 March and 21 May 2025** Related to obtaining license holder information. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	DPIRD raised that activities may have an impact on fish resources and the aquatic environment managed under the WA fisheries legislation. Shell recognised this. Spawning grounds and nursery areas for key fish species are particularly vulnerable to the impacts of spills. DPIRD requested that specific strategies are developed in the Environment Plan and/or OSCPs to mitigate these risks. DPIRD listed specific fish species that may be spawning within the region. Shell confirmed that the EP (and supporting OPEP/OSMP) will address specific strategies to mitigate or minimise impacts. DPIRD requested that in the event of an oil spill or discharge of any pollutant to the environment that it be reported promptly to the WA Department of Transport and to DPIRD within 24 hours. Table 10-13 lists DPIRD as a notification point in the event of an oil spill or discharge of any pollutant which may impact WA managed fish breeding or fish stocks. DPIRD advocates for best practice biofouling management, where biofouling is kept to a minimum to mitigate the risk of harbouring marine pest and disease, including reporting suspected or confirmed presence of any marine pest or disease within 24 hours. Shell confirmed that the Shell Marine Vessel Assurance Program requires all marine vessels planned to be used in the activity area achieve positive vetting through a marine vessel biofouling risk assessment. Reporting requirements are included in the EP (see Section 10.12).	**Relevant matters to this EP** DPIRD noted commercial fisheries and peak fishing sector bodies in WA that Shell should consult with. Shell confirmed that it has consulted with relevant peak fishing sector bodies in WA who were identified as relevant persons. Additionally, Shell confirmed that it had obtained contact information for individual commercial fishers through DPIRD's public register and consulted with them. DPIRD recommended consultation with relevant Traditional Owners. Shell confirmed consultation has taken place with Traditional Owners who are identified as relevant persons. DPIRD gave details required to be included in consultation material, such as start and end dates for the activity and the spatial extent of the activity. Shell has been consulting with commercial fishers and including the information required. DPIRD advised that customary, recreational, and charter fishing resources may also occur within the area. Shell confirmed that it had identified relevant persons within recreational and charter fishing and consulted them as required by the regulations. DPIRD requested that Shell collects baseline marine data to compare against any post-spill monitoring and that this data should be made available to the Department upon request. Shell confirmed it has collected baseline marine data and will continue to suited to the activities. Shell's assessment of baseline monitoring for spill preparedness is outlined within the Operational and Scientific Monitoring arrangements for the EP. Shell confirmed it would provide baseline data, where available and subject to meeting Shell's disclosure requirements, to DPIRD on request. DPIRD requested that Shell ensure all references to legislation are updated. Shell confirmed this would occur. Shell considered all the above relevant matters. However, no new measures were adopted as a result of the matters raised.	DPIRD will be listed as a notification point in the event of an oil spill or discharge of any pollutant which may impact WA managed fish breeding or stocks. Marine vessel biofouling risk assessments will be undertaken for all marine vessels planned to be used in the activity area. Accordingly, consultation in the course of preparation of this EP has been completed.
16.	**Department of Transport and Major Infrastructure (DTMI)**	**Email from Shell** 02 December 2024 *(initial email)* 19 September 2025 24 September 2025 *(final call)* 25 September 2025 **Email from DoT** 06 December 2024 22 September 2025 **Community information session** 08 April 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 06 December 2024 from DTMI** DoT requested that if there is a risk, or change in risk, of a spill impacting State waters from any of the proposed activities, that DTMI is consulted. Noted a new email address for future consultation. **Community information session on 08 April 2025** A local representative attended the Broome Community Information Session, with an interest in Indigenous consultation. **Email on 19 September 2025 from Shell**	No objections or claims received.	**Relevant matter to this EP** New email address noted for future correspondence. Resolved queries related to the 2022 Browse Regional OPEP.	No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.

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			Sharing the Prelude FLNG Operations Environment Plan 5 Yearly Revision – WA Oil Spill Control Agencies Consultation Report for review and comment. **Email on 22 September 2025 from DTMI** Query related to the 2022 Browse Regional OPEP. **Email on 24 September 2025 from Shell** Final call out email with draft EP. **Email on 25 September 2025 from Shell** Response related to the 2022 Browse Regional OPEP, including some historic emails for info.			
17.	**Department of Water & Environmental Regulation (DWER)**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed DWER several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
20.	**Environment Protection Authority (EPA)**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed EPA several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
18.	**Federal Member for Kimberley – Melissa Price**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed Melissa Price several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
19.	**State Member for Kimberley – Divina Grace D'Anna**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed Divinia Grace D'Anna several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
Section 25(1)(c) of the OPGGS(E) Regulations						
28.	**Department of Agriculture and Fisheries - NT (DAF)**	**Email from Shell** 02 December 2024 *(initial email)* 17 December 2024 10 January 2025 27 February 2025 05 March 2025 06 May 2025 13 May 2025 24 September 2025 *(final call)*	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Emails on 17 December 2024 and 10 January 2025** Related to obtaining fishing license contact details. **Email on 27 February 2025 from Shell** Related to obtaining fishing license contact details. **Email on 05 March 2025 from Shell** Reminder email.	No objections or claims received.	Not applicable.	DAF confirmed that they have no issues with the proposed activity. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.

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		Email from DAF-NT 10 January 2025 16 April 2025 14 May 2025	**Email on 16 April 2025 from DAF** Confirming there is no effect or impact to DAF. **Email on 06 and 13 May 2025 from Shell** Related to obtaining fishing license contact details. **Email on 14 May 2025 from DAF** Related to obtaining fishing license contact details. **Email on 24 September 2025 from Shell** Final call email with draft EP.			
27.	**Department of Mines, Petroleum and Exploration (DMPE) formerly Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)**	**Email from Shell** 02 December 2024 *(initial email)* 14 February 2025 24 September 2025 *(final call)* **Email from DEMIRS** 13 February 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 13 February 2025 from DEMIRS** DEMIRS acknowledged receipt of information. They included an email address that should be used for notifications and advised no further information required. **Email on 14 February 2025 from Shell** Shell confirmed email address. **Email on 24 September 2025 from Shell** Final call email with draft EP.	No objections or claims received.	DEMIRS provided an updated email address for notifications, which Shell has noted.	DEMIRS confirmed that they have no issues with the proposed activity. The email address provided will be used for notifications. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
Commercial Fisheries						
Commonwealth Managed Fisheries						
166.	**Australian Northern Prawn Fishery**	**Letter from Shell** 25 February 2025	Shell sent a letter to the Australian Northern Prawn Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
525.	**Christmas Island Fishery** Via Department of Infrastructure, Transport, Regional Development (DITRD)	**Email from Shell** 12 August 2025 *(initial email)* 24 September 2025 *(final call)* **Email from DITRD** 20 August 2025 **Phone call** 12 August 2025	**Phone call on 12 August 2025** DITRD advised that there are three licence holders but only two are currently active. The best way to contact them would be to go through the dept. It was agreed that Shell would share information for distribution and DITRD would advise via return email once information was sent. **Email on 12 August 2025 from Shell** Sufficient information shared with DITRD to pass onto two active fisheries. **Email on 20 August 2025 from DITRD** Confirming information was shared with fisheries. **Email on 24 September 2025 from Shell** Final call email with draft EP.	No objections or claims received.	Not applicable.	*See footnote
149.	**North West Slope Trawl Fishery**	**Letter from Shell** 25 February 2025	Shell sent a letter to North West Slope Trawl Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
613.	**Southern Bluefin Tuna Fishery**	**Letter from Shell** 25 February 2025	Shell sent a letter to Southern Bluefin Tuna Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
156.	**Western Tuna and Billfish Fishery (WTBF)**	**Letter from Shell** 25 February 2025	Shell sent a letter to Western Tuna and Billfish Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
WA Managed Fisheries						
139.	**Abalone Managed Fishery Licence**	**Letter from Shell** 18 February 2025	Shell sent a letter to the Abalone Managed Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
165.	**Aquaculture Sites – WA licences**	**Letter from Shell** 6 March 2025	Shell sent a letter to the Aquaculture Sites WA licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
131.	**Ardyaloon Trochus Hatchery and Aquaculture Centre**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Ardyaloon Trochus Hatchery and Aquaculture Centre several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
183.	**Australia Bay Seafoods**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 (*reminder)* 24 September 2025 *(final call)*	Shell emailed Australia Bay Seafoods several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
141.	**North Coast Prawn Managed Fisheries** Including Broome Prawn, Kimberley Prawn and Onslow and Nickol Bay Prawn Managed Fishery)	**Letter from Shell** 19 February 2025	Shell sent a letter to the Broome Prawn Managed Fishery licence holders, the Kimberley Prawn and Nickol Bay Prawn Managed licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
160.	**Cygnet Bay Pearl Farm**	**Email from Shell** 19 February 2025 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed the Cygnet Bay Pearl Farm several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
144.	**Kimberley Crab Managed Fishery** *Also consulted via WAFIC.*	**Letter from Shell** 19 February 2025	Shell sent a letter to the Kimberley Crab Managed Fishery licence holders with information on this EP with no response. They were also consulted through 155 WAFIC.	No objections or claims received.	Not applicable.	*See footnote
168.	**Kimberley Gillnet and Barramundi Managed Fishery**	**Letter from Shell** 20 February 2025	Shell sent a letter to the Kimberley Gillnet and Barramundi Managed Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
146.	**Mackerel Managed Fishery** *Also consulted via WAFIC.*	**Letter from Shell** 19 February 2025	Shell sent a letter to the Mackerel Managed Fishery licence holders with information on this EP with no response. They were also consulted through 155 WAFIC.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
147.	**Marine Aquarium Fish Managed Fishery** *Also consulted via WAFIC.*	**Letter from Shell** 19 February 2025	Shell sent a letter to the Marine Aquarium Fish Managed Fishery licence holders with information on this EP with no response. They were also consulted through 155 WAFIC.	No objections or claims received.	Not applicable.	*See footnote
148.	**Northern Demersal Scalefish Managed Fishery (NDSMF)** *Also consulted via WAFIC.*	**Email from Shell** 29 January 2025 *(sufficient information)* 06 February 2025 19 February 2025 20 February 2025 *(sufficient information)* 10 March 2025 17 March 2025 27 March 2025 07 April 2025 11 April 2025 15 April 2025 16 April 2025 27 June 2025 30 June 2025 23 October 2025 *(final call)* **Email from NDSMF** 13 January 2025 29 January 2025 06 February 2025 10 March 2025 16 March 2025 08 April 2025 14 April 2025 **Phone call** 17 February 2025 **In person Meeting** 12 March 2025	**Email on 13 January 2025 from NDSMF** Reaching out to discuss EP consultation and concerns about fishing impacts. **Email on 29 January 2025 from Shell** Acknowledging request for direct consultation and confirming Shell would be happy to meet. Provided sufficient information. **Email on 29 January 2025 from NDSMF** Requested a copy of advice from WAFIC and DPIRD. Expressed wish to collaborate and to meet to discuss. **Email on 29 January 2025 from Shell** Acknowledged email and will come back on request. **Email on 06 February 2025 from Shell** Sharing an update on consultation related to WAFIC and DPIRD. **Email on 06 February 2025 from NDSMF** Will be in touch next week to arrange a meeting. **Phone call on 17 February 2025** Calling to discuss a time to meet on the Prelude EP. **Email on 19 February 2025 from Shell** Suggesting a meeting date. **Email on 20 February 2025 from Shell** Letter sent with sufficient information to all license holders [timing aligned with commencement of consultation with Fishers] **Emails on 10 March 2025** Meeting logistics. **In person meeting 12 March 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. NDSMF took Shell through the fishing locations of this fishery and discussed some of the impacts they experience from the oil and gas industry. **Email on 16 March 2025 from NDSMF** Request for information following the meeting.	NDSMF raised that there is an impact to their fishing pots by tugs and LNG tankers. Shell has adopted the industry wide Commercial Fishing Industry Adjustment Protocol prepared by NERA which establishes a baseline standard for loss of catch, displacement and fishing gear loss or damage between oil and gas and the commercial fishing industries. There are many service vessels from various proponents and contractors that occupy the route, which makes it difficult to know who is causing the disruption. Shell requested more data around this fishing gear damage or loss. No data has been received to date.	**Relevant to this EP** NDSMF indicated an interest in working more collaboratively with Shell and highlighted a data sharing opportunity around water temperatures and ROV footage data. Shell shared some sample data with them for feedback. NDSMF indicated that they would like to put together a research proposal. Shell happy to look at supporting this and also recommended that NDSMR look at engaging AEP as industry representative. **Not relevant to this EP** NDSMR requested more information on the Crux pipelay operation, duration, location etc, which Shell shared with them. This was progressed separately from this EP.	Shell has shared data with this fishery in an attempt to increase collaboration. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Email on 17 March 2025 from Shell Confirming that Shell were reviewing the meeting notes and request for information and would share soon. **Email on 27 March 2025 from Shell** Sharing some initial information that had been requested and the meeting notes. **Email on 02 April 2025 from Shell** Sharing some examples of ROV footage. **Email on 08 April 2025 from NDSF** Summarising what is useful information for this fishery. **Email on 11 April 2025 from Shell** Sharing some additional ROV footage and confirming that the request for information was being progressed. **Email on 14 April 2025 from NDSF** Requesting Shell resend the information and querying an aspect of the footage. **Email on 15 April 2025 from Shell** Confirming receipt of email and that the query will be progressed. **Email on 16 April 2025 from Shell** Closing out the query and progressing additional data requested. **Email on 24 June 2025 from NDSF** Request for data and timing for project milestones. **Email on 25 June 2025 from Shell** Confirming Shell is working to get some data over by end of the week and confirming project milestone had been completed. **Email on 27 June 2025 from Shell** Sharing some publicly available research reports. Continuing to progress additional data request. **Email on 30 June 2025 from Shell** Sharing a sample of data reports. **Email on 23 October 2025 from Shell** Final call email with draft EP.			
150.	**Pearl Oyster Fishery**	**Letter from Shell** 19 February 2025	Shell sent a letter to the Pearl Oyster Managed Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
172.	**Pilbara Crab Managed Fishery**	**Letter from Shell** 19 February 2025	Shell sent a letter to the Pilbara Crab Managed Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
172	**Pilbara Fish Trawl Managed Fishery**	**Letter from Shell** 19 February 2025	Shell sent a letter to Pilbara Fish Trawl Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
174	**Pilbara Trap Managed Fishery**	**Letter from Shell** 19 February 2025	Shell sent a letter to Pilbara Trap Managed Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
153.	**Specimen Shell Managed Fishery** *Also consulted via WAFIC.*	**Letter from Shell** 19 February 2025	Shell sent a letter to the Specimen Shell Managed Fishery licence holders with information on this EP with no response. They were also consulted through 155 WAFIC.	No objections or claims received.	Not applicable.	*See footnote
584.	**The Western Australia Sea Cucumber Fishery**	**Letter from Shell** 19 February 2025	Shell sent a letter to the Western Australia Sea Cucumber Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
154.	**West Coast Deep Sea Crustacean Managed Fishery** *Also consulted via WAFIC.*	**Letter from Shell** 19 February 2025	Shell sent a letter to West Coast Deep Sea Crustacean Managed Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
NT Managed Fisheries						
567.	**A1 – NT Coastal Line Fishery**	**Letter from Shell** 08 May 2025	Shell sent a letter to the A1 Coastal Line Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
577	**A2 – NT Coastal Net Fishery**	**Letter from Shell** 14 May 2025	Shell sent a letter to A2 Coastal Net Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
135.	**A4 – NT Spanish Mackerel Fishery**	**Letter from Shell** 20 February 2025	Shell sent a letter to the A4 Spanish Mackerel Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
134.	**A5 – NT Offshore Net and Line Fishery**	**Letter from Shell** 20 February 2025	Shell sent a letter to the A5 Offshore Net Line Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
136.	**A6 – NT Demersal Fishery**	**Letter from Shell** 20 February 2025	Shell sent a letter to the A6 Demersal Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
580.	**A7 – NT Barramundi Fishery**	**Letter from Shell** 20 February 2025	Shell sent a letter to A7 Barramundi Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
573.	**A8 – NT Mud Crab Fishery**	**Letter from Shell** 08 May 2025	Shell sent a letter to the A8 Mud Crab Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
568.	**A10 – NT Pearl Oyster Fishery**	**Letter from Shell** 08 May 2025	Shell sent a letter to the A10 Pearl Oyster Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
133.	**A12 - NT Aquarium Fishery**	**Letter from Shell** 20 February 2025	Shell sent a letter to the A12 Aquarium Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
137.	**A13 – NT Trepang Fishery**	**Letter from Shell** 20 February 2025	Shell sent a letter to the A13 Trepang Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
138.	**A18 - NT Timor Reef Fishery**	**Letter from Shell** 20 February 2025	Shell sent a letter to A18 Timor Reef Fishery licence holders with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
Fishery Associations, Committees and Councils						
523.	**Aquaculture Council of Western Australia (ACWA)**	**Email from Shell** 17 February 2025 *(initial email)*	Shell emailed ACWA several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		23 April 2025 *(reminder)* 24 September 2025 *(final call)*				
179.	**Australian Southern Bluefin Tuna Industry Association (ASBTIA)**	**Email from Shell** 02 December 2024 *(initial email)* 15 January 2025 23 October 2025 *(final call)* **Email from ASBTIA** 14 January 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 14 January 2025 from ASBTIA** Confirming that Prelude operations will not impact their fishing operations and unlikely to impact the migration of Southern Bluefin Tuna. Sharing some detail about Southern Bluefin Tuna. **Email on 15 January 2025 from Shell** Confirming information will be shared with the appropriate team. **Email on 23 October 2025 from Shell** Final call email with draft EP.	No objections or claims received.	ASBTIA shared information about Southern Bluefin Tuna including locations found, spawning fishing information and requesting that Shell factor in spawning grounds and migratory activity into operational considerations.	ASBTIA confirmed that Prelude operations will not impact on their fishing operations. The information received has been reviewed and where appropriate incorporated into the EP. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
142.	**Commonwealth Fisheries Association**	**Email from Shell** 2 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed the Commonwealth Fisheries Association several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
441.	**North Territory Guided Fishing Industry Association (NTGFIA)**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed NTGFIA several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
163.	**Northern Prawn Fishery Industry Pty Ltd**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Northern Prawn Fishery Industry Pty Ltd several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
151.	**Seafood Industry Association**	**Email from Shell** 2 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Seafood Industry Association several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
180.	**Southern Bluefin Tuna Management Advisory Committee (SBTMAC)**	**Email from Shell** 19 February 2025 *(initial email)* 23 April 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed SBTMAC several times with information on this EP with no response.	No objections or claims received.	Not applicable.	*See footnote
181.	**Tropical Tuna Management Advisory Committee**	**Email from Shell**	Shell emailed Tropical Tuna Management Advisory Committee several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		2 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*				
182.	**Tuna Australia**	**Email from Shell** 17 December 2024 *(initial email)* 08 January 2025 15 January 2025 11 March 2025 13 August 2025 15 August 2025 20 August 2025 28 August 2025 24 September 2025 *(final call)* **Email from Tuna Australia** 08 January 2025 15 January 2025 15 August 2025 20 August 2025 29 August 2025 01 October 2025 **Teams meeting** 28 August 2025	**Email on 17 December 2024 from Shell** Initial email. **Emails on 08 January 2025** Email to organise consultation with Tuna Australia and sharing the email to be sent out to members with sufficient information. **Email on 15 January 2025 from Tuna Australia** Confirming receipt of draft email. **Email on 15 January 2025 from Shell** Sharing contact details. **Email on 15 January 2025 from Tuna Australia** Sharing test email to send out to members. **Email on 11 March 2025 from Shell** Sharing community session dates. **Email on 13 August 2025 from Shell** Intro to new contact, request for an update on consultation carried out by Tuna Australia. **Email on 15 August 2025 from Tuna Australia** Confirming consultation has occurred. Reminding Shell of Tuna Australia is notified within 3-5 business days before any activity commences so they can notify their fishers. **Email on 15 August 2025 from Shell** Requesting a call to confirm what has been done. **Email on 20 August 2025 from Shell** Invitation to a Teams meeting. **Emails on 20 August 2025** Related to meeting logistics. **Teams meeting on 28 August 2025** Related to consultation carried out by Tuna Australia for this EP. **Email on 28 August 2025 from Shell** Sharing meeting notes/actions. **Email on 29 August 2025 from Tuna Australia** Agreement on actions. **Email on 24 September 2025 from Shell**	No objections or claims received.	**Relevant to this EP** Tuna Australia request Shell notify Tuna Australia 3-5 business days prior to the commencement of the processing of the processing of Crux Gas. This notification has been included in the ongoing consultation section.	Tuna Australia will be notified at the commencement of the processing of Crux Gas on Prelude, this notification will be conducted by ongoing consultation, included in the Non-Routine External notifications Table 10-11. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Final email with a link to the draft EP. **Email on 01 October 2025 from Tuna Australia** Sharing email sent to members.			
162.	**WA Seafood Exporters**	**Email from Shell** 2 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed WA Seafood Exporters several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
155.	**Western Australian Fishing Industry Council (WAFIC)**	**Email from Shell** 02 December 2024 *(initial email)* 17 December 2024 11 March 2025 12 May 2025 14 May 2025 28 May 2025 09 June 2025 24 September 2025 *(final call)* **Email from WAFIC** 02 December 2024 17 December 2024 28 May 2025 20 May 2025 18 June 2025	**Emails on 02 December 2024** Engaging WAFIC to assist with consultation for this EP and identifying the most appropriate service. **Emails on 17 December 2024 from Shell** • Finalising draft consultation email to share with relevant fishers. • Confirming email and attachments have been shared with the identified fishers. Feedback due on 31 May 2025. • Arranging payment. **Email on 11 March 2025 from Shell** Sharing dates for community sessions. **Email on 12 May 2025 from Shell** Pearling lease enquiry. **Email on 14 May 2025 from Shell** Pearling lease enquiry. **Email on 28 May 2025 from WAFIC** Confirming details are correct and directing Shell to contact the Aquaculture Council related to the Pearl Oyster Aquaculture in WA. **Email on 28 May 2025 from Shell** Thanking them for the advice. **Email on 30 May 2025 from WAFIC** Sharing the consultation report with comments. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP. **Email on 09 June 2025 from Shell** Confirmed there would not be increased vessel traffic related to Prelude. **Email on 18 June 2025 from WAFIC** Highlighting that they appreciate Shell's efforts to engage collaboratively with the fishing industry. They will raise the query with NDFMF.	Fishers in this area have reported damage to, or loss of, their fishing gear due to service vessels running over their floats. While the responsible parties are unknown, fishers within this fishery are requesting Shell to consider implementing a method for marking fishing gear to help reduce gear loss. Shell has adopted the industry wide Commercial Fishing Industry Adjustment Protocol prepared by NERA which establishes a baseline standard for loss of catch, displacement and fishing gear loss or damage between oil and gas and the commercial fishing industries. There are many service vessels from various proponents and contractors that occupy the route, which makes it difficult to know who is causing the disruption. Shell requested more data around this fishing gear damage or loss. No data has been received to date.	**Relevant matters to this EP** Shell to include WAFIC as contact within the Oil spill response planning documents to ensure contact is made within 24 hours of the event notification. Shell confirmed that WAFIC are listed as a notification requirement. During such an event, Shell would appreciate WAFICs assistance in providing communications with the fishing industry. Shell retains a current list of WA commercial fisheries that could potentially be impacted by unplanned spill scenarios. Shell will continue to maintain its contact list for commercial fishers as they relate to the spill scenarios. Shell as required under the Regulations will have a suitable Operational and Scientific Monitoring Program (OSMP), for the purposes of determining impacts and monitoring the recovery of the marine environment. Shell's Browse Regional Bridging Implementation OSMP will be maintained and implemented. WAFIC has developed a position regarding consultation with the WA fishing industry for unplanned events. Shell acknowledged this. WAFIC confirming that the Specimen Shell licence holders be included in the EP list of WA Managed Fisheries in activity / operations area. Shell confirmed they are a relevant person. WAFIC appreciates Shells ongoing communication with mariners regarding issuing notices on activity commencement and distances around temporary exclusion zones. WAFIC asks to be included in any vessel operation look ahead associated with this EP. Existing controls for notifying other marine users of Shell operations are sufficient to inform commercial fishers of our operations. Shell does not intend to provide this information to WAFIC as it would require the development of a bespoke vessel-based look ahead and associated resources to manage throughout the project. Shell will continue to issue relevant notices via the AHO and JRCC, for promulgation across vessel information platforms.	WAFIC are listed as a notification point within 24 hours of an event. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Email on 24 September 2025 from Shell Final email with a link to the draft EP.			
164.	**Western Rock Lobster Council**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Western Rock Lobster Council several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
Titleholders and Operators						
184.	**Carnarvon Energy Ltd**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)* **Email from Carnarvon Energy Ltd** 07 March 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 05 March 2025 from Shell** Reminder email. **Email on 07 March 2025 From Carnarvon Energy Ltd** Advising no further comments. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Carnarvon Energy Ltd confirmed that they have no issues with the proposed activity. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
521.	**Deep C Store Pty Ltd**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Deep C Store Pty Ltd several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
201.	**Eni Australia Ltd**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Eni Australia Ltd several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
201.	**EOG Resources Australia**	**Email from Shell** 10 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed EOG Resources Australia several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
185.	**Finder Energy**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Finder Energy several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
191.	**INPEX**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)*	Shell emailed INPEX several times, with no response. **Community information session – 30 April 2025**	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		24 September 2025 *(final call)* **Community Information Session** 30 April 2025	A representative from INPEX attended the Darwin community information session.			
208.	**IPB Petroleum Ltd**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed IPB-WA several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
186.	**Jadestone Energy**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Jadestone Energy several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
187.	**Melbana Energy**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Melbana Energy several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
212.	**MEO International**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed MEO International several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
216.	**Pathfinder Energy**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Pathfinder Energy several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
188.	**PTTEP Australasia**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed PTTEP Australasia several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
189.	**Santos Ltd**	**Email from Shell** 02 December 2024 *(initial email)* 24 September 2025 *(final call)* **Email from Santos** 13 December 2024	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 13 December 2024 from Santos** Confirming no objections or comments. **Community information session – 30 April 2025**	No objections or claims received.	Not applicable.	Santos Ltd confirmed that they have no issues with the proposed activity. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		08 October 2025 **Community Information Session** 30 April 2025	A representative from INPEX attended the Darwin community information session. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP. **Email on 08 October 2025 from Santos** Confirming no objections or claims.			
221.	**Timor Resources**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Timor Resources several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
220.	**Timor Gap**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)* **Email from Timor Gap** 07 March 2025 29 September 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 07 March 2025 from Shell** Reminder email. **Email on 07 March 2025 from Timor Gap** Advising information will be shared with the relevant department. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP. **Email on 29 September 2025 from Timor Gap** Email has been shared with relevant dept.	No objections or claims received.	Not applicable.	Timor Gap confirmed that they received the information. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.
225.	**Woodside Energy Ltd**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Woodside Energy Ltd several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
Commercial Operators						
235.	**Absolute Ocean Charters**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Absolute Ocean Charters several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
240.	**Auriga Marine**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Auriga Marine several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
239.	**Aurora Expeditions**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Aurora Expeditions several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
270.	**Coral Expeditions**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Coral Expeditions several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
372.	**Eco Abrolhos**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Eco Abrolhos several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
288.	**Fly Broome**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Fly Broome several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
296.	**Kimberley Air Tours**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Kimberley Air Tours several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
297.	**Kimberley Boat Cruises**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Kimberley Boat Cruises several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
298.	**Kimberley Coastal Camp**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Kimberley Coastal Camp several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
302.	**Kimberley Ports Authority** This includes Kimberley Marine Supply Base.	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Kimberley Ports Authority several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
303.	**Kimberley Quest – Beyond Adventure**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Kimberley Quest – Beyond Adventure several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
308.	**Kuri Bay Sport Fishing Tours**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Kuri Bay Sport Fishing Tours several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
309.	**Lady M Cruising**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Lady M Cruising several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
329.	**Odyssey Expeditions**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Odyssey Expeditions several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
330.	**One Tide Charters**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed One Tide Charters several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
228.	**Oolin Sunday Island Cultural Tours**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Oolin Sunday Island Cultural Tours several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
340.	**Reel Teaser**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Reel Teaser several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
349.	**Slick Fishing Charters Broome**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Slick Fishing Charters Broome several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
229.	**The Great Escape Charter Company**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed The Great Escape Charter Company several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
358.	**The Travelling Naturalist**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed The Travelling Naturalist several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
230.	**True North Kimberley Cruises**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed True North Kimberley Cruises several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
374.	**Unreel Adventure Safaris**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Unreel Adventure Safaris several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
Interest Groups						
376.	**10,000 Birds**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed 10,000 Birds several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
437.	**Amateur Fisherman's Association NT**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Amateur Fisherman's Association NT several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
377.	**Australasian Seabird Group**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Australasian Seabird Group several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
381.	**Australasian Wader Studies Group (AWSG)**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)*	Shell emailed Australasian Wader Studies Group (AWSG) several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		24 September 2025 *(final call)*				
375.	**Australian Wildlife Conservancy**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Australian Wildlife Conservancy several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
382.	**Birding in Kimberley**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Birding in Kimberley several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
383.	**Birdlife Top End**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Birdlife Top End several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
378.	**BirdLife WA**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Birdlife WA several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
384.	**Broome Bird Observatory**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Broome Bird Observatory several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
385.	**Broome Fishing Club**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Broome Fishing Club several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
386.	**Broome Surf Life Saving Club**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Broome Surf Life Saving Club several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
388.	**Diving WA Shipwrecks**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)*	Shell emailed Diving WA Shipwrecks several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		24 September 2025 *(final call)*				
390.	**Kimberley Birdwatching**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Kimberley Birdwatching several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
391.	**King Bay Game Fishing Club**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed King Bay Game Fishing Club several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
379.	**Maritime Archaeological Association of Western Australia**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Maritime Archaeological Association of Western Australia several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
380.	**North Kimberley Land Conservation Committee**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed North Kimberley Land Conservation Committee several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
394.	**Recfishwest**	**Email from Shell** 02 December 2024 *(initial email)* **Email from Recfishwest** 07 January 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 07 January 2025 from Recfishwest** Advising no concerns but would like to be updated when Prelude is processing Crux gas.	No objections or claims received.	Requested to be updated when Prelude is processing Crux gas.	Recfishwest confirmed that they have no issues with the proposed activity. Notification has been captured once Prelude is processing Crux gas as part of ongoing consultation. Accordingly, consultation in the course of preparation of this EP has been completed.
393.	**Roebuck Bay Working Group Inc**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Roebuck Bay Working Group Inc several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
Non-Government Organisations						
520.	**Australian Institute of Marine Science (AIMS)**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed AIMS several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
418.	**Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS)**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed AIATSIS several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
399.	**Australian Conservation Foundation**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Australian Conservation Foundation several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
400.	**Australian Marine Conservation Society**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Australian Marine Conservation Society several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
401.	**Australian Marine Oil Spill Centre (AMOSC)**	**Email from Shell** 02 December 2024 *(initial email)* 07 February 2025 13 August 2025 18 September 2025 24 September 2025 *(final call)* **Email from AMOSC** 10 December 2024 13 August 2025 18 September 2025 08 October 2025 **Teams meeting** 25 August 2025 **Phone call** 14 August 2025 from AMOSC – *no answer* 19 August 2025 from Shell – *no answer* 19 August 2025 from AMOSC – *no answer* 22 August 2025 from AMOSC – *no answer* 18 September 2025 from Shell	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 10 December 2024 from AMOSC** Acknowledging receipt of information and requesting further information. **Email on 07 February 2025 from Shell** Acknowledging request for further information and making a commitment to send once available. **Emails on 13 August 2025** Related to setting up a time to chat regarding Indigenous Ranger training and Shell's participation. **Teams meeting on 25 August 2025** Meeting with other oil and gas proponents to progress the opportunity for ranger oil spill training. AMOSC took away some actions to progress this. **Email on 18 September 2025 from Shell** Attempting to make contact my phone. **Phone call on 18 September 2025** Discussion around sharing documents related to this EP. **Email on 18 September 2025 from AMOSC** Providing a shared folder for documentation. **Email on 18 September 2025 from Shell** Confirming documents had been uploaded. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	**Relevant matter to this EP** AMOSC requested a copy of the accepted plans for their records. Shell will supply once available.	AMOSC confirmed that consultation had occurred and requested a copy of the accepted EP once available. Accordingly, consultation in the course of preparation of this EP has been completed.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Email on 08 October 2025 from AMOSC Attaching a letter to confirm AMOSC consultation.			
395.	**Ben and Jerry's**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Ben and Jerry's several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
402.	**Conservation Council of WA**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Conservation Council of WA several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
421.	**Conservation Volunteers Australia**	**Email from Shell** 19 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Conservation Volunteers Australia several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
403.	**Environmental Defenders Office WA (EDO WA)**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed EDO WA several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
404.	**Environs Kimberley**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Environs Kimberley several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
405.	**Greenpeace**	**Email from Shell** 02 December 2024 *(initial email)* 06 August 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Greenpeace several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
406.	**High Seas Alliance**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed High Seas Alliance several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
407.	**Martuwarra Fitzroy River Council**	**Email from Shell** 02 December 2024 *(initial email)*	Shell emailed Martuwarra Fitzroy River Council several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		07 March 2025 *(reminder)* 24 September 2025 *(final call)*				
423.	**Regional Development Australia Kimberley**	**Email from Shell** 19 December 2024 *(initial email)* 23 April 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Regional Development Australia Kimberley several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
410.	**Save the Kimberley**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Save the Kimberley several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
411.	**Sea Turtle.org**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Sea Turtle.org several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
397.	**Surfrider Foundation Australia**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Surfrider Foundation Australia several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
413.	**United Nations**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed United Nations several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
414.	**WA Marine Science Institute (WAMSI)**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed WAMSI several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
415.	**WA Parks Foundation**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed WA Parks Foundation several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
416.	**Wilderness Society**	**Email from Shell** 02 December 2024 *(initial email)*	Shell emailed Wilderness Society several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		07 March 2025 *(reminder)* 24 September 2025 *(final call)*				
427.	**WWF**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed WWF several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
Academic and Research						
432.	**Australian National University (ANU)**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed ANU several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
428.	**Deep History of Sea Country Research Project**	**Email from Shell** 02 December 2024 *(initial email)* 05 February 2025 24 September 2025 *(final call)* **Email from Deep History of Sea Country Research Project** 02 December 2024	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 02 December 2024 from Deep History of Sea Country Research Project** Advising Shell to ensure adequate planning, scheduling and resourcing for underwater cultural heritage assessment. **Email on 05 February 2025 from Shell** Confirming details of Shell's underwater archaeological assessment. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Advice to ensure adequate planning, scheduling and resourcing for underwater cultural heritage assessment. Shell confirmed that underwater archaeological assessment has been commissioned which examines the likelihood of tangible underwater cultural heritage, drowned cultural landscapes and the use of predictive modelling on land usage based on known anthropological data.	*See footnote
433.	**The Ecology Centre (UQ)**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed UQ several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
528.	**Fisheries Research and Development Corporation (FRDC)**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed FRDC several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
429.	**Kimberley Marine Research Station**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Kimberley Marine Research Station several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
Industry Representative Bodies						
440.	**Kimberley Marine Tourism Association**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)* **Community Information Session** 08 April 2025	Shell emailed Kimberley Marine Tourism Association several times, with no response. 08 April 2025 A representative from Kimberley Ports Authority attended the community information session in Broome.	No objections or claims received.	Not applicable.	*See footnote
442.	**Western Australian Game Fishing Association (WAGFA)**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed WAGFA several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
Service Providers						
443.	**Broome Sea Rescue**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Broome Sea Rescue several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
444.	**Broome Volunteers Fire & Rescue Service**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Broome Volunteers Fire & Rescue Service several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
454.	**NT Emergency Service Darwin – Volunteer Unit**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed NT Emergency Service Darwin several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
International RPs						
524.	**Embassy of the Republic of Indonesia**	**Email from Shell** 14 February 2025 *(initial email)* 10 March 2025 11 March 2025 12 March 2025 17 March 2025 20 March 2025 24 September 2025 *(final call)* **Email from Indonesian Embassy**	**Email on 14 February 2025 from Shell** Initial email with sufficient information. **Email on 03 March 2025 from Indonesian Embassy** Asking some questions related to a worst-case scenario that could impact the environment and life in Indonesia and also requesting a briefing. **Email on 03 March 2025 from Shell** Confirming response in next few days. **Email on 10 March 2025 from Shell** Offering opportunity to meet with Shell.	No objections or claims received.	**Relevant matter to this EP** The Indonesian Embassy requested Shell share the details for DFAT, which Shell did. **Not a relevant matter to this EP** The Indonesian Embassy requested more information on the construction of Crux in Indonesia, which is related to a different EP. Shell provided the requested information.	Shell shared contact details for DFAT with the Indonesian Embassy. No additional measures have been adopted. Accordingly, consultation in the course of preparation of this EP has been completed.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		03 March 2025 11 March 2025 12 March 2025 13 March 2025 20 March 2025 **Team meeting** 13 March 2025	**Emails on 11 and 12 March 2025** Meeting arrangements. **Teams meeting on 13 March 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area.. The Indonesian Embassy had an interest in unplanned events and impact on Indonesian Fishers, communities and tourism along the coast. **Email on 13 March 2025 from Indonesian Embassy** Requesting contact details for DFAT and information about the Crux Project in Indonesia. **Email on 17 March 2025 from Shell** Requested information provided as well as the presentation pack from the meeting. **Email on 20 March 2025 from Indonesian Embassy** Query regarding Prelude and Crux. **Email on 20 March 2025 from Shell** Response to question on Crux and sharing links to Environment Plans on NOPSEMA website. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.			
Indigenous Organisations and People						
Tier 1						
38.	**Kimberley Land Council (KLC)** 541. Nyangumarta Karajarri Aboriginal Corporation	**Email from Shell** 12 December 2024 *(initial email)* 11 March 2025 *(reminder)* 24 September 2025 *(final call)* 30 September 2025 **Phone call** 13 May 2025 7 July 2025 13 August 2025 01 October 2025	**Email from Shell on 12 December 2024 from Shell** Initial email with sufficient information. **Email on 11 March 2025 from Shell** Reminder email. **Phone call on 13 May 2025 from Shell** Was advised that the appropriate contact was out of the office. Requested a call back. **Phone call on 7 July 2025 from Shell** KLC instructed Shell to email Nimanburr AC direct via ORIC listed email contact. **Phone call on 13 August 2025 from Shell** Reiterating offer to consult. **Email on 30 September 2025 from Shell** Final email with a link to the draft EP. **Email on 01 October 2025 from KLC** Confirmed receipt and will consider.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Email on 08 October 2025 from Shell Related to consultation with Nyangumarta Karajarri Aboriginal Corporation. Received out of office and re-sent to another contact.			
114.	**Northern Land Council (NLC)** Including. 74. Arnhem Land Aboriginal Land Trust 78. Bulgul Land and Sea (Management) Rangers 80. Croker Island 81. Dak Djerat Guwe People 82. Delissaville / Wagait / Larrakia Aboriginal Land Trust 85. Garngi Land and Sea Management / Garngi Community Rangers 99. Legune Pastoral Lease 100. Malak Malak Land and Water Management Rangers 103. Mardbalk Land and Sea Management / Warruwi Community Mardbalk Marine Rangers 530.Top End Aboriginal Corporation RNTBC 601. Kenbi Rangers 603. Cobourg Peninsula Sanctuary Land Trust	**Email from Shell** 16 December 2024 *(initial email)* 16 December 2024 11 March 2025 *(reminder email)* 12 March 2025 18 July 2025 08 September 2025 24 September 2025 *(final call)* **Email from NLC** 16 December 2024 **Phone call** 05 May 2025 *(no answer)* 08 September 2025	**Email on 16 December 2024 from Shell** Initial email with sufficient information. **Email on 16 December 2024 from NLC** Automatic reply providing alternate contact details. **Email on 16 December 2024 from Shell** Initial email re-sent to contact details in autoreply. **Email on 11 March 2025 from Shell** Reminder email. **Email on 12 March 2025 from Shell** Reminder email re-sent to out of office contact details. **Email on 18 July 2025 from Shell** Requesting NLC distribute information to groups outlined. **Phone call on 08 September 2025 from Shell** Spoke to the legal contact who requested we send through information again to a new contact. Indicated that given distant location of Prelude, it was unlikely to be of interest. **Email on 08 September 2025 from Shell** Re-sending sufficient information to new contact. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in table 5.11.
Tier 2 – WA						
122.	**Balanggarra Aboriginal Corporation (BAC)**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 29 July 2025 *(no answer)*	Shell emailed BAC several times, as well as tried to call with no response.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
29.	**Bardi and Jawi Niimidiman Aboriginal Corporation (BJNAC)**	**Email from Shell** 24 March 2025 *(initial email)* 20 May 2025 06 June 2025 06 October 2025 *(final call)* 10 December 2025	**Email on 24 March 2025 from Shell** Sufficient information on this EP. **Email on 01 May 2025 from BJNAC** Related to revised consultation protocol for Prelude EP. **Email on 20 May 2025 from Shell**	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		12 December 2025 18 December 2025 20 January 2026 21 January 2026 28 January 2026 16 February 2026 **Email from BJNAC** 01 May 2025 18 September 2025 04 December 2025 08 December 2025 09 December 2025 11 December 2025 12 December 2025 18 December 2025 21 January 2026 28 January 2026 **Phone call** 05 June 2025 *(voicemail left)* 02 December 2025 *(voicemail left)* 03 December 2025 04 December 2025 *(voicemail left)* 09 December 2025 **Text messages** 16 February 2026	Response to email related to revised consultation protocol for Prelude EP. **Email on 06 June 2025 from Shell** Following up email of 01 May related to revised consultation protocol. **Email on 18 September 2025 from BJNAC** Proposing an October visit regarding this EP. **Email on 06 October 2025 from Shell** Seeking availability to meet and sharing the draft EP. **Phone call on 03 December 2025** Seeking to organise a meeting – discussion around process, location and payment. **Email on 04 December 2025 from BJNAC** Sharing availability for a meeting in December. **Email on 08 December 2025 from BJNAC** Following up on proposed dates. **Phone call on 09 December 2025** There were two phone calls on this date. 1, advised that Lindal would be the best person to speak to. 2. Call with Lindal further discussed a consultation. Shell confirmed not available to meet by end of the year given availability but would like to lock in dates for 2026. **Email on 09 December 2025 from BJNAC** BJNAC not able to meet until February 2026. **Email on 10 December 2025 from Shell** Requesting a budget for the proposed meeting. Confirming availability to meet in early 2026 and outlining the principles for engagement. Shell also provided a status update on EPs. **Email on 11 December 2025 from BJNAC** Suggesting a meeting date in February 2026. **Emails on 12 December 2025** Confirming meeting date. **Emails on 18 December 2025** Confirming date and location for meeting. **Email on 20 January 2026 from Shell** Confirming meeting in order to book travel. **Email on 21 January 2026 from BJNAC** Working on availability of Directors.			

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Email on 21 January 2026 from Shell Will wait to hear back. **Emails on 28 January 2026** Confirming details for meeting. **Email on 16 February 2026 from Shell** Following up on meeting and whether an alternative date might be preferred. **Text message on 16 February from BJNAC** Requesting the meeting is pushed back. **Text message on 16 February from Shell** Confirming move of meeting – requested a new date.			
77.	**Bidyadanga Aboriginal Community La Grange Inc.**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 29 July 2025	**Email on 02 December 2024 from Shell** Initial email with sufficient information. **Email on 05 March 2025 from Shell** Reminder email. **Phone call on 29 July 2025 from Shell** Confirmed that emails had been received and shared with the CEO. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
31.	**Dambimangari Aboriginal Corporation (DAC)**	**Email from Shell** 13 December 2024 (*initial email)* 16 December 2024 17 January 2025 05 February 2025 24 March 2025 08 April 2025 08 May 2025 04 June 2025 11 June 2025 13 June 2025 27 August 2025 01 October 2025 *(final call)* **Email from DAC** 13 December 2024 15 December 2024 16 December 2024 05 February 2025 24 March 2025 08 April 2025	**In Person meeting on 04 December 2024** Shell presented a number of topics to DAC, including on this EP and included discussion around a number of points of interest related to this EP. **Email on 13 December 2024 from Shell** Initial email with sufficient information, including meeting records and presentation. **Email on 13 December 2024 from DAC** Acknowledging receipt of email. **Email on 13 December 2024 from Shell** Look forward to touching base in 2025. **Emails on 15 and 16 December 2024** Mainly related to amending meeting minutes but also scheduling time to present the underwater cultural heritage report**.** **Email on 17 January 2025 from Shell** Confirming Board meeting dates. **Email on 05 February 2025 from DAC**	No objections or claims received.	**Relevant matters to this EP** DAC requested a presentation at the February Board meeting on the Under Water Cultural Heritage report. Shell accepted offer, whilst there was some movement on the date, Shell presented this in August and responded to any questions during the meeting refer to the meeting minutes. DAC requested a copy of the existing Prelude EP. A link was shared with them on 01 October 2025.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		30 May 2025 13 June 2025 15 July 2025 01 October 2025 **In Person meeting** 04 December 2024 20 August 2025 **Phone call** 10 April 2025	Board satisfied with information presented, no further presentation required. **Email on 05 February 2025 from Shell** Acknowledging Boards decision and advising we will check back in coming months. **Email on 21 March 2025 from DAC** Invitation to Board meeting. **Email on 24 March 2025 from Shell** Accepting invitation and requesting support with advertising community sessions. **Email on 24 March 2025 from DAC** Sharing Teams details for the meeting. **Email on 24 March 2025 from Shell** Confirming Shell attendees. **Emails on 08 April 2025** Meeting arrangements. **Phone call on 10 April 2025** Updated timing for Board meeting. **Email on 08 May 2025 from Shell** Offer to meet to discuss the Underwater Cultural Heritage report further to postponed meeting. **Email on 30 May 2025 from DAC** Proposing new date for the presentation. **Email on 04 June 2025 from Shell** Confirming availability for proposed time. **Email on 11 June 2025 from Shell** Confirming meeting arrangements. **Emails on 13 June 2025** Finalising meeting arrangements. **Email on 15 July 2025 from DAC** Finalising timing for presentation on underwater cultural heritage. **Emails on 16 July 2025** Finalising meeting times. **In Person meeting on 20 August 2025** This meeting was related to sharing Underwater Cultural Heritage research. **Email on 27 August 2025 from Shell**			

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Sharing the presentation from the meeting. **Email on 01 October 2025 from Shell** Final email with a link to the draft EP. **Email on 01 October 2025 from DAC** Acknowledgement receipt. **Email on 01 October 2025 from Shell** Thanking DAC.			
32.	**Djarindjin Aboriginal Corporation (DAC)**	**Email from Shell** 13 December 2024 *(initial email)* 16 December 2024 20 January 2025 19 February 2025 27 February 2025 28 February 2025 07 March 2025 19 March 2025 19 May 2025 28 July 2025 10 September 2025 01 October 2025 *(final call)* **Email from DAC** 13 December 2024 18 February 2025 28 February 2025 07 March 2025 20 March 2025 19 May 2025 29 July 2025 **Phone call** 12 February 2025 *(no answer)* **In person meeting** 28 August 2025 **Community information session** 08 April 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 13 December 2024 from DAC** Sharing the draft meeting schedule for 2025. **Email on 16 December 2024 from Shell** Thanking DAC for the schedule. **Email on 20 January 2025 from Shell** Reaching out to schedule time for consultation on this EP. **Email on 18 February 2025 from DAC** Indicating best timing for a meeting. **Email on 19 February 2025 from Shell** Confirming timing and seeking advice on best timing for a community drop-in session at the same time as the meeting. **Emails on 27, 28 February and 07 March 2025** Meeting arrangements. **Emails on 19 and 20 March 2025** Meeting arrangements. **Community information session on 08 April 2025** Representative from DAC attended the Broome Community information session, with an interest in local content, jobs and social investment. **Email on 19 May 2025 from Shell** Confirming May trip to Djarindjin. **Email on 19 May 2025 from DAC** Confirming there had been a change in date. **Email on 19 May 2025 from Shell** Need to check availability for accommodation, confirming when the next Board meeting is, in case we need to reschedule. **Email on 28 July 2025 from Shell**	No objections or claims received.	**Not relevant to this EP** Other matters were discussed that were not related to this EP, but regarding other Shell projects. These are captured in the meeting notes.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Requesting change of date due to sickness. **Emails on 29 July 2025** Related to meeting arrangements. **In person meeting on 28 August 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also left hard copy information sheets with DAC. **Email on 10 September 2025 from Shell** Sharing presentation and meeting notes as well as closing out actions raised at the meeting. **Email on 11 September 2025 from DAC** Documents were forwarded to the Board. **Email 01 October 2025 from Shell** Final email with a link to the draft EP. **Email 02 October 2025 from Shell** Thank you for sharing with the Board.			
33.	**Gogolanyngor Aboriginal Corporation (GAC)**	**Email from Shell** 13 December 2024 *(initial email)* 16 December 2024 11 March 2025 *(reminder)* 24 September 2025 *(final call)* **Email from GAC** 16 December 2024	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 16 December 2024 from GAC** Acknowledging receipt of email and advising of new contact. **Email on 16 December 2024 from Shell** Confirming Shell will update the contact details. **Email on 11 March 2025 from Shell** Reminder email. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
87.	**Goolarabooloo Millibinyarri Indigenous Corporation**	**Email from Shell** 16 December 2024 *(initial email)* 11 March 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 29 July 2025 *(no answer)*	Shell emailed Goolarabooloo Millibinyarri Indigenous Corporation several times, as well as tried to call with no response.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
35.	**Joombarn-Buru Aboriginal Corporation RNTBC (JBAC)**	**Email from Shell** 13 December 2024 *(initial email)* 17 January 2025 20 January 2025 24 March 2025 28 March 2025 09 April 2025 29 May 2025 25 June 2025 30 June 2025 14 August 2025 24 September 2025 *(final call)* **Email from JBAC** 15 January 2025 20 January 2025 25 March 2025 28 March 2025 31 March 2025 29 May 2025 24 June 2025 25 June 2025 01 July 2025 **Phone call** 12 June 2025 13 August 2025 *(unanswered)* **In person meeting** 18 June 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 15 January 2025 from JBAC** Provided dates of 2025 Board meetings. **Emails on 17 and 20 January 2025** Meeting arrangements. **Emails on 24, 25, 28 and 31 March 2025** Meeting arrangements and consultation protocol. **Email on 09 April 2025 from Shell** Sharing Prelude information sheet and related to meeting arrangements. **Emails on 29 May 2025** Related to meeting arrangements. **Phone call on 12 June 2025** Confirming meeting arrangements. **In person meeting on 18 June 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also left hard copy information sheets with JBAC. **Email on 24 June 2025 from JBAC** Confirming Directors in attendance at the meeting. **Email on 25 June 2025 from Shell** Thanked JBAC and followed up on two other Directors. In separate email on same day, draft meeting records were shared for review. **Email on 25 June 2025 from JBAC** Confirming they are elected alternate Directors. **Email on 30 June 2025 from Shell** Discussion about claim related to helicopters. **Email on 01 July 2025 from JBAC** Thanking Shell for the feedback. **Email on 14 August 2025 from Shell** Confirming Shell will share modelling data to an independent expert. **Email on 24 September 2025 from Shell**	JBAC claimed that transiting helicopters from offshore facilities hold up commercial flights from Broome to Perth. Shell investigated and while the data did not support that this was related to transiting Shell employees, Shell strengthened an existing measure to ensure that no delays should be requested on flights used for demobilisation of Shell staff.	**Relevant matters to this EP** JBAC questioned whether TO's had been consulted in the development of modelling of spill event scenarios. They would like this process to be front ended with consultation and research completed prior to a spill event. Shell confirmed that any feedback provided had been incorporated both into the EP and BROPEP where relevant, and that we are open to feedback on this. Shell to provide modelling data to an independent expert chosen by JBAC. Shell confirmed this could be done by email on 14 August 2025. To date, this has not been requested. **Not relevant to this EP** Discussion related to the consultation protocol and clauses in the protocol that Shell could not commit to. JBAC keen to understand what commercial opportunities exist to supply goods and services to Prelude/Crux from local Indigenous businesses. This will be progressed outside of this EP. Other matters were discussed that were not related to this EP, but regarding other Shell projects. These are captured in the meeting notes.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Final email with a link to the draft EP.			
93.	**Kalumburu Aboriginal Corporation**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 23 July 2025 24 July 2025 25 July 2025 28 July 2025 04 August 2025 24 September 2025 *(final call)* 12 December 2025 18 March 2026 24 March 2026 25 March 2026 **Email from Kalumburu** 24 July 2025 28 July 2025 04 August 2025 11 December 2025 16 February 2026 19 March 2026 24 March 2026 25 March 2026 **Phone call** 22 July 2025 **Teams meeting** 30 July 2025 23 April 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 11 March 2025 from Shell** Reminder email. **Phone call on 22 July 2025 from Shell** Follow-up to previous communications with former Kalumburu AC CEO to reiterate offer to consult on-country with Kalumburu AC or hold community meeting if requested. **Email on 23 July 2025 from Shell** Re-sharing sufficient information and offer to meet. **Email on 24 July 2025 from Legal Counsel** Suggesting Kalumburu CEO respond directly. **Email on 24 July 2025 from Shell** Thanking Legal Counsel. **Email on 24 July 2025 from Kalumburu** Requesting a Teams meeting to discuss. **Email on 25 July from Shell** Proposing a time for the Teams meeting. **Email on 28 July from Shell** Rescheduling Teams meeting. **Email on 28 July 2025 from Kalumburu** Confirming availability for new time. **Teams meeting on 30 July 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. **Email on 04 August 2025 from Kalumburu** Confirming potential meeting actions. **Email on 04 August 2025 from Shell** Re-shared consultation material and actions from meeting. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP. **Email on 11 December 2025 from Kalumburu** Confirming documents received and will be reviewed at the next Board meeting, Following that there will be a response.	No objections or claims received.	**Relevant matters to this EP** Shell shared information related to EP consultation with Kalumburu including video links. Shell shared information related to logistics for a community consult. Kalumburu to confirm interest and viability with Shell. To date nothing has been confirmed. Meeting minutes and actions from the meeting are still to be finalised. **Not relevant to this EP** Shell to share furthering information on scholarship and NETTS programs.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Email on 12 December 2025 from Shell Confirming email received and advising of staff movements. **Email on 16 February 2026 from Kalumburu [received via the Environment panel on 18 February]** Requesting email be passed onto Shell. Email included a Position Statement. **Email on 18 March 2026 from Shell** Updating on status of EPs. Reiterating offer to meet. **Email on 19 March 2026 from Kalumburu** Offer for Shell to present at the next KAC Directors meeting. **Emails on 24 and 25 March 2026** Accepting the offer to meet and finalising arrangements **Teams meeting held on 23 April 2026** Shell share information on Prelude with an opportunity to ask questions.			
36.	**Karajarri Traditional Lands Association (KTLA)**	**Email from Shell** 16 December 2024 *(initial email)* 11 March 2025 *(reminder)* 24 September 2025 *(final call)* 09 October 2025 **Phone call** 29 July 2025	**Email on 16 December 2024 from Shell** Initial email with sufficient information. **Email on 11 March 2025 from Shell** Reminder email. **Phone call on 29 July 2025 from Shell** Confirmed that emails had been received, they will contact us if they want us to present to the Board. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
39 / 37.	**Kimberley Ranger Network (KRN) / Indigenous Salt Water Advisory Group (ISWAG)** These records have been combined as the contact is the same. **Including:** 602.Balanggarra Rangers 30. Bardi Jawi Rangers 605.Nyul Nyul Rangers 542. Bardi Jawi Oorany Rangers	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 15 July 2025 18 July 2025 05 September 2025 09 September 2025 16 September 2025 17 September 2025 01 October 2025 *(final call)*	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 11 March 2025 from Shell** Reminder email. **Email on 15 July 2025 from Shell to the Bardi Jawi Oorany Rangers** Shared initial email with sufficient information. **Email on 18 July 2025 from Shell** Following up on consultation offer.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		28 October 2025 **Email from KRN / ISWAG** 22 July 2025 05 September 2025 08 September 2025 16 September 2025 17 September 2025 **Teams meeting** 23 September 2025	**Email on 22 July 2025 from KRN** Confirming emails had been received and they will get back to us. **Email on 05 September 2025 from Shell** Reiterating offer to consult. **Email on 05 September 2025 from KRN / ISWAG** Looking to align a meeting. **08 September 2025 from KRN / ISWAG** Proposed meeting time. **Email on 09 September 2025 from Shell** Confirming availability for 16 September. **Email on 16 September 2025 from KRN / ISWAG** Cancelling the meeting. **Email on 16 September 2025 from Shell** No issues, will wait to hear when suits to reschedule. **Emails on 17 September 2025** Lining up a new meeting time. **Teams meeting on 23 September 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. **Email on 01 October 2025 from Shell** Final email with a link to the draft EP. **Email on 28 October 2025 from Shell** Related to oil spill training for ranger groups.			
41.	**Kullari Regional Communities Incorporated (KRCI)**	**Email from Shell** 16 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 29 July 2025	**Email on 16 December 2024 from Shell** Initial email with sufficient information. **Email on 7 March 2025 from Shell** Reminder email. **Phone call on 29 July 2025 from Shell** Confirmed that emails had been received, CEO will call back if they require any further information. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
42.	**Lombadina Aboriginal Corporation including Accommodation and Tours**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)*	Shell emailed Lombadina Aboriginal Corporation several times, as well as tried to call with no response.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		24 September 2025 *(final call)* **Phone call** 05 September 2025 *(no answer)*				
44.	**Mayala Inninalang Aboriginal Corporation (incl Mayala 2)**	**Email from Shell** 13 December 2024 *(initial email)* 16 December 2024 11 March 2025 *(reminder)* 24 September 2025 *(final call)* **Email from Mayala** 16 December 2024 **Phone call** 23 July 2025 *(no answer)*	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 16 December 2024 from Mayala** Advising will be in touch in February. **Email on 16 December 2024 from Shell** Agreed to talk in February. **Email on 11 March 2025 from Shell** Reminder email. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
105.	**Miriuwung-Gajerrong (Western Australia)**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 18 July 2025 *(no answer)* 22 July 2025 *(no answer)*	Shell emailed Miriuwung-Gajerrong several times, as well as tried to call with no response.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
113.	**Nimanburr Aboriginal Corporation**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 7 July 2025 24 September 2025 *(final call)* **Email from KLC** 13 December 2024 **Phone call** 7 July 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 13 December 2025 from KLC** Confirming information had been passed to Nimanburr. **Email on 11 March 2025 from Shell** Reminder email. **Phone call on 7 July 2025 from Shell** KLC instructed Shell to email Nimanburr AC direct via ORIC listed email contact. **Email on 7 July 2025 from Shell** Re-sending sufficient information and offer to consult to new ORIC contact. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
51.	**Nyul Nyul PBC Corporation**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 12 March 2025 10 April 2025 23 May 2025 17 June 2025 18 June 2025 24 September 2025 *(final call)* **Email from Nyul Nyul/KLC** 13 December 2024 12 March 2025 10 April 2025 17 April 2025 22 May 2025 23 May 2025 18 June 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 13 December 2024 from Nyul Nyul** Acknowledging receipt of information. **Email on 11 March 2025 from Shell** Reminder email. **Email on 12 March 2025 from KLC** Invited Shell to present at May Board meeting. **Email on 12 March 2025 from Shell** Accepted invitation. **Email on 10 April 2025 from Shell** Seeking confirmation of date of Board meeting. **Email on 10 April 2025 from KLC** No date set at this stage. **Email on 17 April 2025 from Nyul Nyul** Requesting Shell are on the agenda for the next Board meeting. **Email on 22 May 2025 from KLC** Proposing timing for Board meeting. **Emails on 23 May 2025** Meeting arrangements. **Email on 17 June 2025 from Shell** Seeking a new date for the meeting and reiterating offer to consult. **Email on 18 June 2025 from KLC** Will let us know when a date is available. **Email on 18 June 2025 from Shell** Thanking KLC. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
54.	**Walalakoo Aboriginal Corporation incl. Nyikina Mangala Rangers**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 13 May 2025	**Email from 13 December 2025 from Shell** Initial email with sufficient information. **Email on 11 March 2025 from Shell** Reminder email. **Phone call on 13 May 2025** Shell called Walalakoo and spoke with reception. Walalakoo shared a new contact for the acting GM. Shell attempted to call this number but there was no answer.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		13 May 2025 – *no answer* **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.				
55.	**Wanjina-Wunggurr (Native Title) Aboriginal Corporation (WWAC)**	**Emails from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 14 May 2025 15 May 2025 19 May 2025 22 May 2025 06 June 2025 20 June 2025 24 September 2025 *(final call)* **Emails from WWAC/ KLC** 15 May 2025 19 May 2025 22 May 2025 **Phone call** 09 May 2025 13 May 2025 12 June 2025 **In person meeting** 20 May 2025	**Email from 13 December 2025 from Shell** Initial email with sufficient information. **Email on 11 March 2025 from Shell** Reminder email. **Phone call on 09 May 2025 from Shell to KLC** Spoke to reception and confirmed contact details. **Phone call on 13 May 2025** Advised to follow ORIC contact details and send follow up email. **Email on 14 May 2025 from Shell** Providing initial email again to the ORIC contact with sufficient information. **Emails on 15 May 2025 from KLC** Related to presenting at the next Board meeting. **Email on 15 May 2025 from Shell** Confirming Shell's availability to present. **Emails on 19 May 2025** Meeting arrangements. **In person meeting on 20 May 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets. **Emails on 22 May and 06 June 2025** Post meeting arrangements **Phone call on 12 June 2025** Related to post meeting arrangements. **Email on 20 June 2025 from Shell** Providing draft meeting and copy of presentation. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	**Relevant to this EP** Shell to consider funding FTE resource for TO Groups to aid consultation opportunities. We offer an Environmental Panel for assistance with reviewing the EP and provide independent advice. Shell confirmed we are progressing the oil spill training for rangers via an industry collaboration with AMOSC. Shell to connect separately with Wunambal Gaambera to offer an opportunity to consult directly. Shell attempted to progress this with Wunambal Gaambera and await a response. **Not relevant to this EP** Shell to connect WWAC with Select Carbon personnel to discuss potential carbon project. Shell to provide WWAC with information on the NETTS Apprenticeship intake and Grants Coordinator program. These will be progressed outside the EP.	Please see justification for consultation closed outlined in table 5.11.
57.	**Wilinggin Aboriginal Corporation (WAC)**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 03 April 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 11 March 2025 from Shell** Reminder email.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		05 May 2025 24 September 2025 *(final call)* **Email from WAC** 03 April 2025	**Email on 03 April 2025 from WAC** Advising of new CEO contact. **Email of 03 April 2025 from Shell** Thank you for passing this on. **Email on 05 May 2025 from Shell** Email to new contact with sufficient information. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.			
125.	**Wunambal Gaambera Aboriginal Corporation (WGAC) (including the Uunguu Rangers)**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 28 May 2025 24 September 2025 *(final call)* **Phone call** 05 May 2025 *(no answer)*	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 11 March 2025 from Shell** Reminder email. **In person meeting on 20 May 2025** This was a consult with Wanjina-Wunggurr (Native Title) Aboriginal Corporation, which some representative from WGAC attended. At this meeting an invite was extended to Shell to meet directly with WGAC on country. **Email on 28 May 2025 from Shell** Follow up to see if they would like to arrange a meeting related to WGAC. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in table 5.11.
49.	**Yawuru Native Title Holders Aboriginal Corporation RNTBC**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 8 July 2025 14 August 2025 08 September 2025 01 October 2025 *(final call)* **Email from Yawuru** 4 July 2025 8 July 2025 14 August 2025 **Phone call** 1 July 2025 11 August 2025 **Teams meeting** 21 August 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 11 March 2025 from Shell** Reminder email. **Phone call on 1 July** Follow-up to previous emails sent and reiterating offer to consult on this EP. **Email on 4 July 2025 from Yawuru** Invitation to present at Board meeting. **Email on 8 July from Shell** Accepting offer to present. **Email on 8 July 2025 from Yawuru** Confirming they will be in touch. **Phone call on 11 August** To finalise details for upcoming meeting. **Email on 14 August 2025 from Yawuru** Confirming timing for meeting.	No objections or claims received.	**Relevant matters to this EP** Yawuru expressed interest in oil spill training for Rangers. Shell is progressing this as an industry coordinated by AMOSC.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Email on 14 August 2025 from Shell Confirming Shell attendees. **Teams meeting on 21 August 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. **Email on 01 October 2025 from Shell** Final email with a link to the draft EP. **Email on 08 September 2025 from Shell** Sharing presentation and draft minutes from the meeting.			
Tier 2 – NT						
97.	**Larrakia Development Corporation**	**Email from Shell** 16 December 2024 *(initial email)* 25 July 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 25 July 2025 *(no answer)*	Shell emailed Larrakia Development Corporation several times, as well as tried to call with no response.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
129.	**Larrakia Nation Aboriginal Corporation**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 17 March 2025 23 April 2025 24 September 2025 *(final call)* **Email from Larrakia Nation** 13 March 2025 17 March 2025 **In person meeting** 30 April 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 11 March 2025 from Shell** Reminder email. **Email on 13 March 2025 from Larrakia Nation** Confirming they will advertise the community session on their socials. Requested a meeting. **Emails on 17 March 2025** Meeting arrangements. **Email on 23 April 2025 from Shell** Meeting arrangements. **In person meeting on 30 April 2025** Discussion related to Shell's social investment programs. Nothing related to this EP. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
108.	**Munupi Aboriginal Corporation**	**Email from Shell** 16 December 2024 *(initial email)* 23 April 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 10 September 2025 – *no answer*	Shell emailed Munupi Aboriginal Corporation several times, as well as tried to call with no response.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
118	**Thamurrur Development Corporation including Thamurrur Rangers**	**Email from Shell** 16 December 2024 *(initial email)* 11 March 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 25 July 2025 *(no answer)*	Shell emailed Thamurrur Development Corporation several times, and tried calling them, with no response.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
119.	**Tiwi Land Council (TLC)** Incl. Tiwi Marine Rangers 91. Jikilaruwu (Bathurst Island) 101. Malawu (Bathurst Island) 102. Mantiyupwi (Bathurst and Melville Island) 104. Marrikawuyanga (Melville Island) 531. Wulirankuwu (Melville Island) 532. Wurankuwu (Bathurst Island) 127. Yimpinari (Melville Island) 107. Munupi (Melville Island)	**Email from Shell** 16 December 2024 *(initial email)* 25 July 2025 *(reminder)* **Phone call** 09 September 2025 *(no answer)*	Shell emailed TLC several times, and tried calling them, with no response.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.
607.	**Top End Aboriginal Coastal Alliance (TEACA)**	**Email from Shell** 13 December 2024 *(initial email)* 16 January 2025 17 January 2025 12 February 2025 27 February 2025 05 March 2025 06 March 2025 10 March 2025 11 March 2025 17 March 2025 20 March 2025 02 April 2025 09 April 2025 10 April 2025 11 April 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Emails on 16 and 17 January 2025** Proposed meeting dates and travel arrangements. **Phone Call on 29 January 2025** Follow-up on email exchange discussing dates for consultation with TEACA Consultative Committees for this EP. **Emails on 06, 12, 16 and 27 February 2025** Discussing cost estimates for meetings. **Emails on 03 and 05 March 2025** Finalising cost estimates for meetings and further meeting logistics including GIS shape files.	No objections or claims received.	Not applicable.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		17 April 2025 22 April 2025 28 April 2025 29 April 2025 30 April 2025 05 May 2025 07 May 2025 08 May 2025 09 May 2025 24 June 2025 02 July 2025 03 July 2025 07 July 2025 17 July 2025 05 August 2025 07 August 2025 08 August 2025 24 September 2025 *(final call)* 24 November 2025 26 November 2025 **Email from TEACA** 17 January 2025 06 February 2025 12 February 2025 16 February 2025 03 March 2025 05 March 2025 07 March 2025 15 March 2025 18 March 2025 08 April 2025 10 April 2025 16 April 2025 17 April 2025 18 April 2025 24 April 2025 27 April 2025 07 May 2025 09 May 2025 25 June 2025 01 July 2025 02 July 2025 06 July 2025 07 July 2025 18 July 2025 31 July 2025 07 August 2025 26 November 2025 **Phone Call** 29 January 2025	**Email on 06 March 2025 from Shell** Invite to Teams meeting. **Teams Meeting on 07 March 2025** Discussion on logistics for travel. **Email on 07 March 2025 from TEACA** Travel itinerary incorporating changes. **Email on 10 March 2025 from Shell** Meeting logistics. **Email on 11 March 2025 from Shell** Providing shape files. **Email on 15 March 2025 from TEACA** Providing member details. **Email on 17 and 20 March 2025 from Shell** Meeting logistics. **Email on 02 April 2025 from Shell** Sharing notice of consults for w/c 28 April. **Email on 09 April 2025 from Shell** Sharing draft meeting records. **Emails on 08, 09 and 10 April 2025** Confirming attendance for meetings. **Email on 11 April 2025 from Shell** Sharing draft meeting records. **Email on 16 April 2025 from TEACA** Notes on draft meeting records. **Emails on 17 April 2025 from Shell** Notes on draft meeting records. **Email on 17 April 2025 from TEACA** Confirming preferred approach for consultation. **Email on 18 April 2025 from TEACA** Accepting meeting notes for Cobourg Consultative Committee (Tiwi based). **Email on 18 April 2025 from TEACA** Raising additional consultation should take place with Ngoy Garmak Consultative Committee – given intersection of relevant sea country with the planning area. **Email on 22 April 2025 from Shell** Acknowledged receipt.			

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		24 June 2025 30 June 2025 **Teams Meeting** 07 March 2025 *Note: individual consultative meeting notes captured against each individual consultative committee below.*	**Email on 24 April 2025 from TEACA** Confirming attendance for meetings. **Email on 27 April 2025 from TEACA** Notes on draft meeting records. **Email on 28 April 2025 from Shell** Sharing final meeting notes for Maningrida Regional Consultative Committee. **Email on 29 April 2025 from Shell** Sharing meeting records. **Email on 30 April 2025 from Shell** Confirming additional consultative committee added to consultation program. **Email on 05 May 2025 from Shell** Thanking for support with organising committees. Disappointed that the meeting with Gapu Maringa Consultative Committee was unable to take place. Confirmed plans to reschedule – seeking guidance on dates. **Email on 07 May 2025 from TEACA** Confirming attendance for meetings. **Email on 07 May 2025 from Shell** Acknowledged receipt. **Email on 08 May 2025 from Shell** Sharing meeting records. **Emails on 09 May 2025 from TEACA** Three emails: sharing meeting records in two of the emails and the third confirming approach for consultation with Gapu Maringa Consultative Committee and Ngoy Garmak Consultative Committee. **Email on 09 May 2025 from Shell** Three emails: confirming dates for consultation and sharing meeting records. **Phone call on 24 June 2025** Discussing logistics for upcoming consultation. **Email on 24 June 2025 from Shell** Actions from phone call related to consultation. **Email on 25 June 2025 from TEACA** Meeting logistics. **Phone call on 30 June 2025** Meeting logistics.			

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Emails on 01 July 2025 from TEACA Discussing cost estimates for meetings and meeting logistics. **Email on 02 July 2025 from Shell** Meeting logistics. **Email on 02 July 2025 from TEACA** Confirming attendance for meetings. **Email on 03 July 2025 from Shell** Confirming attendance for meetings. **Email on 06 July 2025 from TEACA** Discussing cost estimates for meetings and meeting logistics. Guidance on consultation if unable to reschedule some meetings. **Emails on 07 July 2025** Meeting logistics. **Email on 17 July 2025 from Shell** Sharing notice of consults w/c 21 July. **Emil on 18 July 2025 from TEACA** Acknowledging receipt. **Emil on 31 July 2025 from TEACA** Providing attendance records. **Email on 05 August 2025 from Shell** Two emails sharing draft meeting notes. **Emails on 07 and 08 August 2025** Providing and further discussion related to attendance records. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP. **Email on 24 November 2025 from Shell** Closing out an action related to consultations. **Emails on 26 November 2025** Confirming information will be passed onto committees and requesting meeting dates for 2026.			
535.	**Cobourg First Nations Consultative Committee**	**In Person meeting** 27 March 2025 *(Wurrumiyanga)* 03 April 2025 *(Jabiru)*	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here. **In person meeting on 27 March 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as	No objections or claims received.	**Not relevant matter to this EP** Shell to organise further information on Select Carbon. Shell to provide information on relevant social investment programs. Both of these are not relevant matters to this EP and so will be progressed separately.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets. **In person meeting on 03 April 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.			
610.	**Djulidki First Nations Consultative Committee**	**In Person meeting** 06 November 2024	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here. **In person on 06 November 2024** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.	No objections or claims received.	**Relevant matter to this EP** The committee directed Shell to a report completed by the Thamarrurr Rangers outlining the finding of local skink and mouse previously thought to be extinct and an Impact Report completed for the Bradshaw Defence ILUA that provided environmental and social impact assessment. Shell researched the matter and found it was not relevant to the planning area of this EP. Shell to provide the committee with draft EP. Shell completed this via TEACA. **Not relevant matter to this EP** A number of actions were raised not relevant to this EP, but to Shell's business e.g. social investment programs. These are being actioned by Shell. Shell was invited to present to the Bradshaw Liaison Committee on the Crux project. After assessing this, Shell determined they did not have any functions, interests or activities that may be affected, and therefore, are not a relevant person however may explore future engagement if relevant to Shell's business.	Please see justification for consultation closed outlined in Table 5.11.
538.	**Gapu Maringa First Nations Consultative Committee**	**Teams meeting** 24 July 2025	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here. **In person on 24 July 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.	No objections or claims received.	No matters raised.	Please see justification for consultation closed outlined in Table 5.11.
537.	**Goulburn Islands First Nations Consultative Committee**	**In person meeting** 29 April 2025	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here. **In person on 29 April 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.	No objections or claims received.	**Not relevant matter to this EP** Related to Shell's NETTS program. This will be progressed outside of this EP.	Please see justification for consultation closed outlined in Table 5.11.
533.	**Jindiwi First Nations Consultative Committee**	**In person meeting** 01 April 2025	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here. **In person on 01 April 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.	No objections or claims received.	**Relevant matter to this EP** Shell to share details of the Environment Panel, including where they are located. Shell completed this. **Not relevant matter to this EP** Shell to share information related to the Grants Writer, NTIBN and Scholarship programs. This was progressed outside of this EP.	Please see justification for consultation closed outlined in Table 5.11.
611.	**Kardu Lalingkin First Nations Consultative Committee**	**In person meeting** 08 November 2024	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here.	No objections or claims received.	**Not a relevant matter to this EP** An action was raised not relevant to this EP, but to Shells business e.g. social investment programs. This is being actioned by Shell as a separate matter.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			In person on 08 November 2024 Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.			
536.	**Maningrida Regional First Nations Consultative Committee (MRCC)**	**In person meeting** 25 March 2025	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here. **In person on 25 March 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.	No objections or claims received.	**Relevant matter to this EP** Shell to confirm that the current BROPEP contacts include TEACA committee. This was completed. Shell to consider including time series of oil spill modelling in future consultations, this is something that Shell will take onboard for consideration. **Not relevant matters to this EP** MRCC to provide a priority for investment consideration. This will be progressed outside of this EP.	Please see justification for consultation closed outlined in Table 5.11.
534.	**Mulurryud First Nations Consultative Committee**	**In person meeting** 02 April 2025	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here. **In person on 02 April 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.	No objections or claims received.	**Relevant matter to this EP** Shell to confirm that the current BROPEP contacts include TEACA committee. This was completed. Shell to share details of the Environment Panel, including where they are located. Shell completed this. **Not relevant matter to this EP** Shell to share information related to the Grants Writer, NTIBN and Scholarship programs. This was progressed outside of this EP.	Please see justification for consultation closed outlined in Table 5.11.
539.	**Ngoy Garmak First Nations Consultative Committee**	**In person meeting** 22 July 2025	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here. **In person on 22 July 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.	No objections or claims received.	**Not relevant matter to this EP** A number of actions were raised not relevant to this EP, but to Shells business e.g. social investment programs. These are being actioned by Shell as a separate matter.	Please see justification for consultation closed outlined in Table 5.11.
609.	**Rak Badjalarr First Nations Consultative Committee**	**In person meeting** 15 October 2024	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here. **In person on 15 October 2024** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.	No objections or claims received.	**Relevant matter to this EP** Shell to provide information around approach to management of sacred sites where information provided by TO groups. Shell has provided this information. **Not relevant matters to this EP** A number of actions were raised not relevant to this EP, but to Shells business e.g. social investment programs. These are being actioned by Shell as a separate matter.	Please see justification for consultation closed outlined in Table 5.11.
540.	**Tiwi Clans First Nations Consultative Committee**	**In person meeting** 26 March 2025	Consultation occurred through 607 TEACA for this RP. Only meeting notes are captured here. **In person on 26 March 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets.	No objections or claims received.	**Relevant matter to this EP** Shell shared statistics related to cargo vessels used for offloading in an email response on 24 November 2025. **Not relevant matters to this EP** A number of actions were raised not relevant to this EP, but to Shells business e.g. social investment programs. These are being actioned by Shell as a separate matter.	Please see justification for consultation closed outlined in Table 5.11.

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
Tier 3						
72.	**Anindilyakwa Land Council**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Anindilyakwa Land Council several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
73.	**Ardi'ol Art & Culture**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Ardi'ol Art & Culture several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
75.	**Asburton Aboriginal Corporation**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Ashburton Aboriginal Corporation several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
60.	**Cheeditha Art Group**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Cheeditha Art Group several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
79.	**Crocodile Islands Rangers / Maringa Ocean Patrol**	**Email from Shell** 16 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Crocodile Islands Rangers / Maringa Ocean Patrol several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
83.	**Dhimurru Aboriginal Corporation**	**Email from Shell** 16 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Dhimurru Aboriginal Corporation several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
67.	**Djarindjin Campgrounds**	**Email from Shell** 02 December 2024 *(initial email)* 05 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Djarindjin Campgrounds several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
89.	**Gumurr Marthakal Rangers**	**Email from Shell** 12 March 2025 *(initial email)* 23 April 2025 *(reminder)*	Shell emailed Gumurr Marthakal Rangers several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		24 September 2025 *(final call)*				
94.	**Kariyarra Aboriginal Corporation**	**Email from Shell** 13 December 2024 *(initial email)* 11 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Kariyarra Aboriginal Corporation several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
95.	**Kimberley Aboriginal Law and Cultural Centre (KALACC)**	**Email from Shell** 13 December 2024 *(initial email)* 20 January 2025 24 January 2025 28 January 2025 20 February 2025 11 March 2025 *(reminder)* 13 March 2025 17 March 2025 02 April 2025 08 April 2025 09 April 2025 24 September 2025 *(final call)* **Email from KALACC** 22 January 2025 28 January 2025 20 February 2025 12 March 2025 14 March 2025 25 March 2025 08 April 2025 09 April 2025 **Phone calls** 24 February 2025 *(left a message)* **In Person meeting** 15 April 2025	**Email on 13 December 2024** Initial email with sufficient information. **Emails on 20, 22, 24 and 28 January 2025** Related to scheduling a meeting. **Emails on 20 February 2025** Related to scheduling a meeting. **Email on 11 March from Shell** Reminder email. **Email on 12, 13, 14 and 15 March 2025** Confirming date for Board meeting. **Email on 25 March 2025 from KALACC** Additional meeting arrangements. **Email on 02 April 2025 from Shell** Finance related. **Emails on 08 April 2025** Meeting logistics. **Emails on 09 April 2025** Finance related. **In person meeting on 15 April 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	**Relevant matters to this EP** Shell to consider oil spill training for ranger groups as well as a fee for service model. This is being progressed with an industry group facilitated by AMOSC. **Not relevant matters to this EP** Matter raised related to Shell's recruitment process which will be progressed outside of this EP.	*See footnote
62.	**Kimberley Cultural Adventures**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Kimberley Cultural Adventures several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
96.	**Kimberley Jiyigas**	**Email from Shell**	Shell emailed Kimberley Jiyigas several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		12 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*				
40.	**KRED (Ambooriny Burru Charitable organisation)**	**Email from Shell** 12 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed KRED several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
63.	**Mabu Buru Tours**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Mabu Buru Tours several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
56.	**Madanaa Nada Aboriginal Corporation RNTBC**	**Email from Shell** 16 December 2024 *(initial email)* 11 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Madanaa Nada Aboriginal Corporation RNTBC several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
70.	**Mercedes Cove Exclusive Coastal Retreat**	**Email from Shell** 12 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Mercedes Cove Exclusive Coastal Retreat several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
45.	**Mowanjum Aboriginal Art & Culture Centre**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Mowanjum Aboriginal Art & Culture Centre several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
522.	**Mowanjum Aboriginal Corporation**	**Email from Shell** 16 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Mowanjum Aboriginal Corporation several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
109.	**Murujuga Aboriginal Corporation including the land and sea unit.**	**Email from Shell** 16 December 2024 *(initial email)* 23 April 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Murujuga Aboriginal Corporation several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
46.	**Nagula Jarndu Women's Arts and Resource Centre**	**Email from Shell**	Shell emailed Nagula Jarndu Women's Arts and Resource Centre several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*				
64.	**Narlijia Experiences Broome**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Narlijia Experiences Broome several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
48.	**Northern Australian Indigenous Land and Sea Management Alliance (NAILSMA)**	**Email from Shell** 16 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed NAILSMA several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
132.	**NT Indigenous Business Network (NTIBN)**	**Email from Shell** 13 December 2024 *(initial email)* 16 December 2024 24 February 2025 31 March 2025 01 April 2025 02 April 2025 24 September 2025 *(final call)* **Email from NTIBN** 13 December 2024 31 March 2025 01 April 2025 03 April 2025 28 April 2025 **Teams meeting** 24 February 2025 **Community Information Session** 30 April 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 13 December 2024 from NTIBN** NTIBN keen to host another industry briefing early next year. **Email on 16 December 2024 from Shell** Will be in touch early next year to discuss further. **Teams meeting on 24 February 2025** Planning discussion around community information session. **Email on 24 February 2025 from Shell** Following on from call and sharing the Prelude Information Sheet. **Emails on 31 March, 01, 02 and 03 April 2025 from NTIBN** Meeting arrangements. **Email on 28 April 2025 from NTIBN** To their member base to invite them to the Community Information session. **Community Information Session on 30 April 2025** Session held at the NTIBN offices and invite extended to the NTIBN network. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.	No objections or claims received.	Not applicable.	*See footnote
115.	**Nyangumarta Warrarn Aboriginal Corporation (NWAC)**	**Email from Shell** 16 December 2024 *(initial email)*	**Email on 16 December 2024 from Shell** Initial email with sufficient information.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		09 May 2025 05 September 2025 24 September 2025 *(final call)* **Email from NWAC** 30 April 2025	**Email on 30 April 2025 from NWAC** Expressing interest in re-engaging with Shell for this EP. **Email on 09 May 2025 from Shell** Confirming they are relevant for this EP and Shell would be open to consult with them. **Email on 05 September 2025 from Shell** Reminder email for opportunity to consult. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.			
52.	**Pudakul Aboriginal Cultural Tours**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Pudakul Aboriginal Cultural Tours several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
116.	**Saltwater Cultural Tours**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Saltwater Cultural Tours several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
53.	**Specialised Indigenous Services**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Specialised Indigenous Services several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
117.	**Tarntipi Bushcamp**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed Tarntipi Bushcamp several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
121.	**Tiwi Resources Pty Ltd**	**Email from Shell** 16 December 2024 *(initial email)* 13 August 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 13 August 2025 *(no answer)*	Shell emailed Tiwi Resources several times and tried calling with no response.	No objections or claims received.	Not applicable.	*See footnote
66.	**WAITOC**	**Email from Shell** 02 December 2024 *(initial email)* 07 March 2025 *(reminder)*	Shell emailed WAITOC several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
		24 September 2025 *(final call)*				
123.	**Wanparta Aboriginal Corporation**	**Email from Shell** 13 December 2024 *(initial email)* 19 December 2024 21 February 2025 06 March 2025 12 March 2025 14 April 2025 04 May 2025 05 May 2025 22 May 2025 29 May 2025 03 June 2025 17 June 2025 14 August 2025 24 September 2025 *(final call)* **Email from Wanparta** 19 December 2024 06 March 2025 10 March 2025 12 March 2025 13 March 2025 14 April 2025 30 April 2025 05 May 2025 28 May 2025 03 June 2025 16 June 2025 20 June 2025 23 June 2025 19 August 2025 **In person meeting** 06 May 2025	**Email on 13 December 2024 from Shell** Initial email with sufficient information. **Email on 19 December 2024 from Wanparta** Will liaise with us in February for a meeting. **Email on 19 December 2024 from Shell** Look forward to touching base in February. **Email on 21 February 2025 from Shell** Touching base about a meeting this year. **Email on 06 March 2025 from Wanparta** Looking at a meeting in April or May. **Email on 06 March 2025 from Shell** We will wait to hear back. **Email on 10 March 2025 from Wanparta** Will confirm meeting timing this week. **Email on 12 March 2025 from Wanparta** Confirming date and time of meeting and checking availability for 6 May. **Email on 12 March 2025 from Shell** Confirming availability. **Email on 13 March 2025 from Wanparta** Will be in touch closer to the time. **Email on 14 April 2025 from Wanparta** Sharing estimates for the meeting. **Email on 14 April 2025 from Shell** Shell agreeable to the estimates. **Email on 30 April 2025 from Wanparta** Sharing the draft agenda for the meeting. **Emails on 04 and 05 May 2025** Finalising meeting arrangements. **In person meeting on 06 May 2025** Shell presented tailored presentation on this EP, including detailed information on environmental impacts and risks, and associated management measures in place as well as the worst credible case scenarios and modelling results for arriving at the planning area. Shell also shared hard copies of the relevant information sheets. **Email on 22 May 2025 from Shell**	No objections or claims received.	**Relevant matters to this EP** Provided information regarding the cultural importance of Sea Country, marine life, including totem species, and a healthy marine environment, which Shell considers to be relevant matters and are appropriately addressed in the EP – see measures adopted for detail. Wanparta requested Shell attend at least one Board meeting per calendar year for the purposes of progressing ongoing and meaningful consultations with the Ngarla People, as relevant person. Wanparta indicated an interest in the underwater cultural heritage survey. Shell confirmed that it is currently at pilot stage with an initial focus on the Kimberley zone. Shell will be in contact if subsequent phases of the project extend to Ngarla sea country. Shell to keep Wanparta updated on progress with oil spill ranger training to potentially include Wanparta. **Not relevant matters to this EP** Wanparta expressed an interest in Shell funding for the Ngarla Ranger program. This was progressed outside of this EP. Shell to send Directors information on NETTS program, Grants Coordinator contact details and MADALAH Indigenous Scholarship program.	

RP Number	Relevant Person	Dates of correspondence and follow up	Summary of Consultation / Efforts to Consult	Assessment of merits of objection or claim	Relevant and not relevant matters to this EP	Measures adopted and justification for consultation carried out
			Attaching meeting records and presentation. **Email on 28 May 2025 from Wanparta** Attaching marked up meeting minutes. **Email on 28 May 2025 from Wanparta** Attaching correspondence related to consultation. **Email on 29 May 2025 from Shell** Finalising the meeting records. **Email on 03 June 2025 from Wanparta** Confirming Wanparta happy with the amendments. **Email on 03 June 2025 from Shell** Sharing final meeting records. **Emails on 16, 17, 20 and 23 June 2025** Finalisation of payment. **Email on 14 August 2025 from Shell** Providing feedback to requests raised during consultation. **Email on 19 August 2025 from Wanparta** Will share updates with the Board. **Email on 24 September 2025 from Shell** Final email with a link to the draft EP.			
124.	**Wirrawandi Aboriginal Corporation**	**Email from Shell** 16 December 2024 *(initial email)* 13 August 2025 *(reminder)* 24 September 2025 *(final call)*	Shell emailed WAC several times, with no response.	No objections or claims received.	Not applicable.	*See footnote
126.	**Yagbani Aboriginal Corporation**	**Email from Shell** 16 December 2024 *(initial email)* 07 March 2025 *(reminder)* 24 September 2025 *(final call)* **Phone call** 29 July 2025 *(no answer)*	Shell emailed Yagbani Aboriginal Corporation several times, with no response.	No objections or claims received.	Not applicable.	*See footnote

Footnote.

*In accordance with Shell's approach to consultation, attempts have been made to contact this relevant person during a reasonable period with no response received to date. Other mechanisms have been used to comply with Shell's requirement to consult with relevant persons on the proposed activity, for example an advertising campaign conducted from February – April 2025. Relevant persons can provide feedback to Shell via the EP webpage during the implementation of the EP with any new relevant matters assessed in accordance with the EP (Section 5.8). Consultation in the course of preparation of the EP has been completed in accordance with the OPGGS(E) Regulations.

Appendix C EPBC Act Protected Matters Reports

Appendix C1 – PMST results for Prelude Planning Area

Appendix C2 – PMST results for Prelude Activity Area

Appendix C3 – PMST results for Light Assessment Area

Appendix C4 – PMST results for Noise Assessment Area.

Appendix C1 – PMST results for Prelude Planning Area

Australian Government

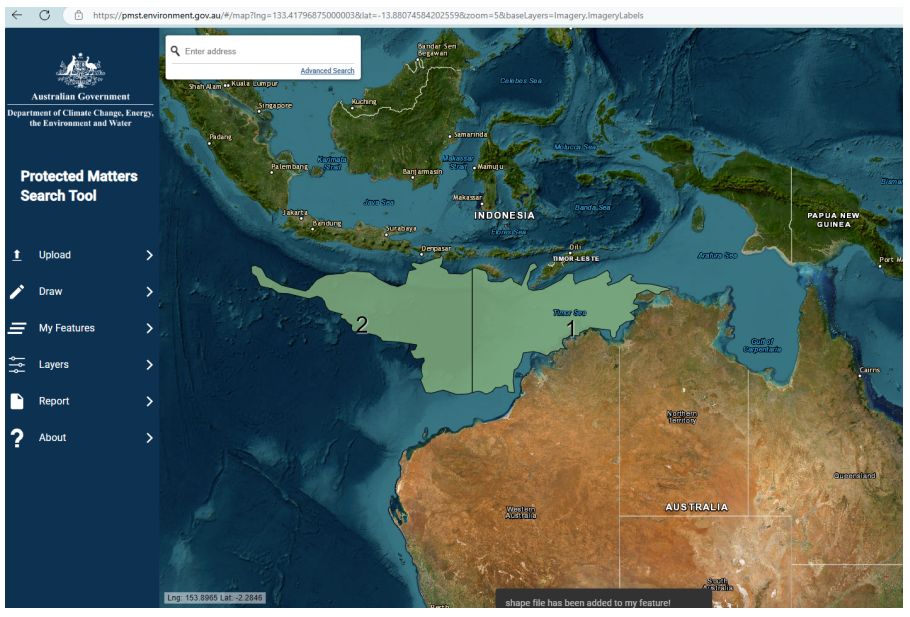
Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Planning Area

Report created: 29-May-2025



[Summary](#)

[Details](#)

- [Matters of NES](#)
- [Other Matters Protected by the EPBC Act](#)
- [Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance (Ramsar	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	15
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	78
Listed Migratory Species:	73

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	3
Commonwealth Heritage Places:	3
Listed Marine Species:	136
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	20
Habitat Critical to the Survival of Marine Turtles:	4

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	11
Regional Forest Agreements:	None
Nationally Important Wetlands:	4
EPBC Act Referrals:	183
Key Ecological Features (Marine):	11
Biologically Important Areas:	65
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

National Heritage Places		[Resource Information]
Name	State	Legal Status
Natural		
The West Kimberley	WA	Listed place

Wetlands of International Importance (Ramsar Wetlands)	[Resource Information]
Ramsar Site Name	Proximity
Ashmore reef national nature reserve	Within Ramsar site
Cobourg peninsula	Within Ramsar site

Commonwealth Marine Area	[Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
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Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Feature Name
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat likely to occur within area
Chloebia gouldiae listed as Erythrura gouldiae Gouldian Finch [90091]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Foraging, feeding or related behaviour known to occur within area
Geophaps smithii blaauwi Partridge Pigeon (western) [66501]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Endangered	Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat likely to occur within area
Melanodryas cucullata melvillensis Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands) [67092]	Critically Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti		
Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Phaethon rubricauda westralis		
Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Breeding known to occur within area
Pluvialis squatarola		
Grey Plover [865]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula albifrons		
Little Tern [82849]	Vulnerable	Breeding known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli		
Masked Owl (northern) [26048]	Vulnerable	Species or species habitat known to occur within area
Tyto novaehollandiae melvillensis		
Tiwi Masked Owl, Tiwi Islands Masked Owl [26049]	Endangered	Species or species habitat known to occur within area
MAMMAL		
Antechinus bellus		
Fawn Antechinus [344]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Isoodon auratus auratus Golden Bandicoot (mainland) [66665]	Vulnerable	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
Mesembriomys gouldii gouldii Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat known to occur within area
Mesembriomys gouldii melvillensis Black-footed Tree-rat (Melville Island) [87619]	Vulnerable	Species or species habitat known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Breeding known to occur within area
Petrogale concinna canescens Nabarlek (Top End) [87606]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Petrogale concinna monastria		
Nabarlek (Kimberley) [87607]	Endangered	Species or species habitat known to occur within area
Phascogale pirata		
Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat likely to occur within area
Phascogale tapoatafa kimberleyensis		
Kimberley brush-tailed phascogale, Brush-tailed Phascogale (Kimberley) [88453]	Vulnerable	Species or species habitat likely to occur within area
Saccolaimus saccolaimus nudicluniatus		
Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Sminthopsis butleri		
Butler's Dunnart [302]	Vulnerable	Species or species habitat known to occur within area
Sousa sahulensis		
Australian Humpback Dolphin [87942]	Vulnerable	Breeding known to occur within area
Trichosurus vulpecula arnhemensis		
Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat known to occur within area
Xeromys myoides		
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat known to occur within area
PLANT		
Burmannia championii listed as Burmannia sp. Bathurst Island (R.Fensham 1021)		
[93461]	Endangered (listed as Burmannia sp. Bathurst Island	Species or species habitat likely to occur within area
Elaeocarpus miegei		
[65147]	Endangered	Species or species habitat known to occur within area
Mitrella tiwiensis		
a vine [82029]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Tarennoidea wallichii [65173]	Endangered	Species or species habitat known to occur within area
Typhonium jonesii a herb [62412]	Endangered	Species or species habitat likely to occur within area
Typhonium mirabile a herb [79227]	Endangered	Species or species habitat likely to occur within area
Xylopia monosperma a shrub [82030]	Endangered	Species or species habitat known to occur within area
REPTILE		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus fuscus Dusky Sea Snake [1119]	Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Tiliqua scincoides intermedia Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat known to occur within area
Varanus mertensi Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat known to occur within area
Varanus mitchelli Mitchell's Water Monitor [1569]	Critically Endangered	Species or species habitat likely to occur within area
SHARK		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Breeding known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Foraging, feeding or related behaviour known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]	Vulnerable	Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica		
Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis		
Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres		
Ruddy Turnstone [872]	Vulnerable	Species or species habitat likely to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area
Calidris alba		
Sanderling [875]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus		
Whimbrel [849]		Species or species habitat likely to occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Pluvialis squatarola		
Grey Plover [865]	Vulnerable	Species or species habitat likely to occur within area
Thalasseus bergii		
Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State
Unknown	
Commonwealth Land - [52276]	ACI
Commonwealth Land - [52277]	ACI
Commonwealth Land - [52278]	ACI

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Ashmore Reef National Nature Reserve	EXT	Listed place
Mermaid Reef - Rowley Shoals	WA	Listed place
Scott Reef and Surrounds - Commonwealth Area	EXT	Listed place

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area overfly marine area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous minutus Black Noddy [824]		Breeding known to occur within area
Anous stolidus Common Noddy [825]		Breeding known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Species or species habitat likely to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris alba Sanderling [875]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Vulnerable	Species or species habitat likely to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Foraging, feeding or related behaviour known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat likely to occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat likely to occur within area
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Breeding known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Species or species habitat likely to occur within area overfly marine area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]	Vulnerable	Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalasseus bengalensis as Sterna bengalensis Lesser Crested Tern [66546]		Breeding known to occur within area
Thalasseus bergii as Sterna bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area
Fish		

Scientific Name	Threatened Category	Presence Text
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys sculptus Sculptured Pipefish [66197]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Cosmocampus maxweberi Maxweber's Pipefish [66209]		Species or species habitat may occur within area
Doryrhamphus baldwini Redstripe Pipefish [66718]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Halicampus macrorhynchus Whiskered Pipefish, Ornate Pipefish [66222]		Species or species habitat may occur within area
Halicampus mataafae Samoan Pipefish [66223]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippichthys spicifer Belly-barred Pipefish, Banded Freshwater Pipefish [66232]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
[Trachyrhamphus bicoarctatus](#) Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
[Trachyrhamphus longirostris](#) Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
[Dugong dugon](#) Dugong [28]		Breeding known to occur within area
Reptile		
[Aipysurus apraefrontalis](#) Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
[Aipysurus duboisii](#) Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
[Aipysurus foliosquama](#) Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
[Aipysurus fuscus](#) Dusky Sea Snake [1119]	Endangered	Species or species habitat known to occur within area
[Aipysurus laevis](#) Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
[Aipysurus mosaicus as Aipysurus eydouxii](#) Mosaic Sea Snake [87261]		Species or species habitat may occur within area
[Aipysurus tenuis](#) Brown-lined Sea Snake, Mjoberg's Sea Snake [1121]		Species or species habitat may occur within area
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area
Ephalophis greyae as Ephalophis greyi Mangrove Sea Snake [93738]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Sea Snake, Banded Sea Snake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Cogger's Sea Snake, Black-headed Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Sea Snake [59233]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area
Hydrophis inornatus Plain Sea Snake [1107]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis zweifeli as Enhydrina schistosa		
Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area
Lepidochelys olivacea		
Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni		
Arafura Smooth Sea Snake, Northern Mangrove Sea Snake [1090]		Species or species habitat may occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis		
Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata		
Pygmy Killer Whale [61]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]	Vulnerable	Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Christmas Island	Habitat Protection Zone (IUCN IV)
Kimberley	Habitat Protection Zone (IUCN IV)
Oceanic Shoals	Habitat Protection Zone (IUCN IV)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)
Kimberley	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Christmas Island	National Park Zone (IUCN II)
Kimberley	National Park Zone (IUCN II)
Mermaid Reef	National Park Zone (IUCN II)
Oceanic Shoals	National Park Zone (IUCN II)
Ashmore Reef	Recreational Use Zone (IUCN IV)
Ashmore Reef	Sanctuary Zone (IUCN Ia)
Cartier Island	Sanctuary Zone (IUCN Ia)
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles		[Resource Information]
Scientific Name	Behaviour	Presence
All year (Jun - Aug)		
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		

Scientific Name	Behaviour	Presence
Dermochelys coriacea Leatherback Turtle [1768]	Nesting	Known to occur
May - Jul		
Lepidochelys olivacea Olive Ridley Turtle [1767]	Nesting	Known to occur
Oct - Mar		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Browse Island	Nature Reserve	WA
Garig Gunak Barlu	National Park	NT
Garig Gunak Barlu	Marine Park	NT
Lalang-gaddam	Marine Park	WA
Low Rocks	Nature Reserve	WA
Niiwalarra Islands	National Park	WA
North Kimberley	Marine Park	WA
Prince Regent	National Park	WA
Rowley Shoals	Marine Park	WA
Scott Reef	Nature Reserve	WA
Unnamed WA41775	5(1)(h) Reserve	WA

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Ashmore Reef	EXT
Cobourg Peninsula System	NT
Finniss Floodplain and Fog Bay Systems	NT
Mermaid Reef	EXT

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
2 geotechnical surveys - preliminary and final	2006/2886		Completed
Boskalis Cambridge Gulf Marine Sand Sourcing Project	2025/10106		Referral Decision
Browse Carbon Capture and Storage Project	2024/10028		Referral Decision
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319		Approval
Darwin Pipeline Duplication (DPD) Project	2022/09372		Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260		Completed
Marine Route Survey for Subsea Fibre Optic Data Cable System - Australia West	2024/09826		Completed
Northern Endeavour Phase 1 Decommissioning	2022/09327		Post-Approval
Project Crux Cable Lay and Operation	2022/09441		Completed
Project Fitzroy Expansion Offshore Cable Lay	2023/09674		Referral Decision
Puffin Oil wells 7, 8 & 9 development	2005/2336		Completed
Tiwi H2 Project	2022/09347		Assessment
Controlled action			
2-D seismic survey Scott Reef	2000/125	Controlled Action	Post-Approval
Audacious Oil Field Standalone Development	2001/407	Controlled Action	Completed
Bonaparte Liquified Natural Gas Project	2011/6141	Controlled Action	Post-Approval
Browse FLNG Development, Commonwealth Waters	2013/7079	Controlled Action	Post-Approval
Conduct an exploration drilling campaign	2010/5718	Controlled Action	Completed
Decommissioning of Buffalo Oil Field	2003/984	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Decommissioning of Challis Oilfield	2003/942	Controlled Action	Post-Approval
Develop Ichthys gas-condensate field permit area W	2006/2767	Controlled Action	Completed
Development of Blacktip Gas Field	2003/1180	Controlled Action	Post-Approval
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Floating Liquefied Natural Gas facility	2001/533	Controlled Action	Completed
Hardwood Plantation	2001/229	Controlled Action	Post-Approval
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Kilimiraka Mineral Sands and Associated Infrastructure (Bathurst Island), NT	2012/6587	Controlled Action	Assessment Approach
Montara 4, 5, and 6 Oil Production Wells, and Montara 3 Gas Re-Injection Well	2002/755	Controlled Action	Post-Approval
Nava-1 Cable System	2001/510	Controlled Action	Completed
Prelude Floating Liquefied Natural Gas Facility and Gas Field Development	2008/4146	Controlled Action	Post-Approval
PTTEP AA Floating LNG Facility	2011/6025	Controlled Action	Completed
Tassie Shoal Gas Reforming and Methanol Production Plants - NT/P48	2000/108	Controlled Action	Post-Approval
Tassie Shoal LNG Project	2003/1067	Controlled Action	Post-Approval
Torosa South Initial Appraisal Drilling	2007/3500	Controlled Action	Completed
Not controlled action			
2D seismic survey, exploration permit NT/P67	2004/1587	Not Controlled Action	Completed
2D Seismic Survey in Permit Areas WA-318-P & WA-319-P, near Cape Londonderry	2004/1687	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
3D marine seismic survey in WA 314P and WA 315P	2004/1927	Not Controlled Action	Completed
Adele Trend TQ3D Seismic Survey	2001/252	Not Controlled Action	Completed
AEC International Hydrocarbon Well Puffin 6	2000/36	Not Controlled Action	Completed
Audacious-3 oil drilling well	2003/1042	Not Controlled Action	Completed
Backpacker-1 Offshore Hydrocarbon Exploration Well	2001/300	Not Controlled Action	Completed
Barossa-1 (NT/P69), Caldita-2 (NT/P61) exploration wells	2006/2793	Not Controlled Action	Completed
Buffalo In-Fill Production Wells	2001/475	Not Controlled Action	Completed
Caldita-1 Hydrocarbon Exploration Well, NT/P61	2004/1854	Not Controlled Action	Completed
Construction and operation of Radar Infrastructure	2004/1406	Not Controlled Action	Completed
Controlled Source Electromagnetic 2D Survey	2009/4980	Not Controlled Action	Completed
Controlled Source Electromagnetic Survey	2010/5434	Not Controlled Action	Completed
Coot-1 hydrocarbon exploration well, Permit Area AC/L2 or AC/L3	2001/296	Not Controlled Action	Completed
Crux-A and Crux-B appraisal wells, Petroleum Permit Area AC/P23	2006/2748	Not Controlled Action	Completed
Crux gas-liquids development in permit AC/P23	2006/3154	Not Controlled Action	Completed
Drilling of 12 Hydrocarbon Exploration Wells, Permit Area WA-371-P	2006/3005	Not Controlled Action	Completed
Drilling of exploration well Audacious-1 in AC/P17	2000/5	Not Controlled Action	Completed
Drilling of exploration wells, Permit areas WA-301-P to WA-305-P	2002/769	Not Controlled Action	Completed
Drilling of Marina-1 Exploration Well	2007/3586	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Echuca Shoals-2 Exploration of Appraisal Well	2006/3020	Not Controlled Action	Completed
Exploration Drilling in AC/P17, AC/P18 and AC/P24	2001/359	Not Controlled Action	Completed
Exploration Well AC/P23	2001/234	Not Controlled Action	Completed
INDIGO West Submarine Telecommunications Cable, WA	2017/8126	Not Controlled Action	Completed
Kaleidoscope exploration well	2001/182	Not Controlled Action	Completed
Marine Seismic Survey in WA-239-P	2000/24	Not Controlled Action	Completed
Marine Survey for the Australia-ASEAN Power Link AAPL	2020/8714	Not Controlled Action	Completed
Montara-3 Offshore Hydrocarbon Exploration Well Permit Area AC/RL3	2001/489	Not Controlled Action	Completed
Nexus Drilling Program NT-P66	2007/3745	Not Controlled Action	Completed
NT/P68 2007 Two Well Drilling Program	2007/3569	Not Controlled Action	Completed
P30 Hydrocarbon Exploration Well	2001/293	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Saucepan 1 Exploration Well ACP23	2000/2	Not Controlled Action	Completed
Skua and Swift Oilfields	2006/3195	Not Controlled Action	Completed
Strumbo-1 Gas Exploration Well Permit Area WA-288-P	2002/884	Not Controlled Action	Completed
WA-295-P Kerr-McGee Exploration Wells	2001/152	Not Controlled Action	Completed
Woodside Geotechnical Investigation Sunrise Bank	2000/13	Not Controlled Action	Completed
Not controlled action (particular manner)			
2 (3D) Marine Seismic Surveys	2009/4994	Not Controlled Action (Particular Manner)	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
2D and 3D Seismic Survey	2011/6197	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D Seismic Survey WA-405-P	2009/5104	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D Seismic Survey WA-405-P	2008/4133	Not Controlled Action (Particular Manner)	Post-Approval
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey of Braveheart,Kurrajong,Sunshine and Crocodile	2006/2917	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey within permit area WA-318-P	2007/3879	Not Controlled Action (Particular Manner)	Post-Approval
2D or 3D Marine Seismic Survey in Petroleum Permit Area AC/P35	2009/4864	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Marine Survey	2001/363	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey in permit areas WA-274P and WA-281P	2004/1521	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey in WA Permit Area TP/22 and Commonwealth Permit Area WA-280-P	2005/2100	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey - Petroleum Exploration Area NT/P68, Eastern Bonaparte Basin	2006/2922	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
3D Marine Seismic Survey	2008/4437	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey	2009/4681	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey, Permit AC/P 23	2005/2364	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey (WA-482-P, WA-363-P), WA	2013/6761	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic Survey - Maxima 3D MSS	2006/2945	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey	2006/2729	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, Browse Basin, WA	2009/5048	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, near Scott Reef, Browse Basin	2005/2126	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, petroleum exploration permit AC/P33	2006/2918	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey (NT/P68)	2008/4121	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey (NT/P68)	2006/2980	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
3D seismic survey of AC/P4, AC/P17 and AC/P24	2006/2857	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey WA-406-P Bonaparte Basin	2007/3904	Not Controlled Action (Particular Manner)	Post-Approval
AC/P37 3D Seismic Survey Ashmore Cartier	2007/3774	Not Controlled Action (Particular Manner)	Post-Approval
Auralandia 3D marine seismic survey	2011/5961	Not Controlled Action (Particular Manner)	Post-Approval
Aurora MC3D Marine Seismic Survey	2010/5510	Not Controlled Action (Particular Manner)	Post-Approval
Australia to Singapore Fibre Optic Submarine Cable System	2011/6127	Not Controlled Action (Particular Manner)	Post-Approval
Bassett 3D Marine Seismic Survey	2010/5538	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 2D & 3D marine seismic survey	2011/5962	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 3D & 2D Seismic Survey, in NT/P82, Timor Sea	2012/6398	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Basin Seabed Mapping Survey	2009/4951	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte Seismic and Bathymetric Survey	2012/6295	Not Controlled Action (Particular Manner)	Post-Approval
Braveheart 2D Infill Marine Seismic Survey 100km offshore	2008/4442	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Braveheart 2D Marine Seismic Survey	2005/2322	Not Controlled Action (Particular Manner)	Post-Approval
Caldita 3D Marine Seismic Survey - NT/P61, NT/P69, and acreage release area NT06-5	2006/3142	Not Controlled Action (Particular Manner)	Post-Approval
Canis 3D Marine Seismic Survey	2008/4492	Not Controlled Action (Particular Manner)	Post-Approval
Cartier East and Cartier West 3D Marine Seismic Surveys	2009/5230	Not Controlled Action (Particular Manner)	Post-Approval
Caswell MC3D Marine Seismic Survey	2012/6594	Not Controlled Action (Particular Manner)	Post-Approval
Conduct an exploration drilling campaign	2011/5964	Not Controlled Action (Particular Manner)	Post-Approval
Dillon South-1 Exploration Well Drilling - AC/P4, Territory of Ashmore/Cartier	2013/6849	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of Audacious-5 appraisal well	2008/4327	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of Exploration & Appraisal Wells Braveheart-1 & Cornea-3	2009/5160	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of two appraisal wells	2011/5840	Not Controlled Action (Particular Manner)	Post-Approval
Endurance 3D Marine Seismic Data Acquisition Survey	2007/3667	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Exploration Drilling Campaign	2011/6047	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Campaign, Browse Basin, WA-341-P, AC-P36 and WA-343-P	2013/6898	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling in Permit Areas WA-402-P & WA-403-P	2010/5297	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Program - Permit areas - WA-314-P, WA-315-P, WA-398-P.	2008/4064	Not Controlled Action (Particular Manner)	Post-Approval
Fishburn2D Marine Seismic Survey	2012/6659	Not Controlled Action (Particular Manner)	Post-Approval
Floyd 3D and Chisel 3D Seismic Surveys	2011/6220	Not Controlled Action (Particular Manner)	Post-Approval
Geoscience Australia - Marine survey in Browse Basin to acquire data to assist assessment of CO2 sto	2013/6747	Not Controlled Action (Particular Manner)	Post-Approval
Gicea 3D Marine Seismic Survey	2008/4389	Not Controlled Action (Particular Manner)	Post-Approval
Gigas 2D Pilot Ocean Bottom Cable Marine Seismic Survey	2007/3839	Not Controlled Action (Particular Manner)	Post-Approval
Gold 2D Marine Seismic Survey Permit Areas WA375P and WA376P	2009/4698	Not Controlled Action (Particular Manner)	Post-Approval
Ichthys 3D Marine Seismic Survey	2010/5550	Not Controlled Action (Particular Manner)	Post-Approval
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Joseph Bonaparte Gulf Seabed mapping survey	2010/5517	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Klimt 2D Marine Seismic Survey	2007/3856	Not Controlled Action (Particular Manner)	Post-Approval
Koolama 2D Seismic Survey Dampier Basin	2010/5420	Not Controlled Action (Particular Manner)	Post-Approval
Kraken, Lusca & Asperus 3D Marine Seismic Survey	2013/6730	Not Controlled Action (Particular Manner)	Post-Approval
Laying a submarine optical fibre telecommunications cable, Perth to Singapore and Jakarta	2014/7332	Not Controlled Action (Particular Manner)	Post-Approval
Malita West 3D Seismic Survey WA-402-P and WA-403-P	2007/3936	Not Controlled Action (Particular Manner)	Post-Approval
Marine Environmental Survey 2012	2012/6310	Not Controlled Action (Particular Manner)	Post-Approval
Mariner Non-Exclusive 2D Seismic Survey	2011/6172	Not Controlled Action (Particular Manner)	Post-Approval
Nova 3D Seismic Survey	2013/6825	Not Controlled Action (Particular Manner)	Post-Approval
NT/P77 3D Marine Seismic Survey	2009/4683	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
NT/P80 2010 2D Marine Seismic Survey	2010/5487	Not Controlled Action (Particular Manner)	Post-Approval
Octantis 3D Marine Seismic Survey, Permit Area AC/P41 off northern Western Australia	2007/3369	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Canning Multi Client 2D Marine Seismic Survey	2010/5393	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Exploration Drilling Campaign	2011/6222	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Gas Exploration Drilling Campaign	2012/6384	Not Controlled Action (Particular Manner)	Post-Approval
Outer Canning exploration drilling program off NW coast of WA	2012/6618	Not Controlled Action (Particular Manner)	Post-Approval
Petrel MC2D Marine Seismic Survey	2010/5368	Not Controlled Action (Particular Manner)	Post-Approval
Pilot Appraisal Well - Torosa South 1	2008/3991	Not Controlled Action (Particular Manner)	Post-Approval
Removal of Potential Unexploded Ordnance within NAXA	2012/6503	Not Controlled Action (Particular Manner)	Post-Approval
Repsol 3d & 2D Marine Seismic Survey	2012/6658	Not Controlled Action (Particular Manner)	Post-Approval
Rosebud 3D Marine Seismic Survey in WA-30-R and TR/5	2012/6493	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Sandalford 3D Seismic Survey	2012/6261	Not Controlled Action (Particular Manner)	Post-Approval
Santos Petrel-7 Offshore Appraisal Drilling Programme (Bonaparte Basin)	2011/5934	Not Controlled Action (Particular Manner)	Post-Approval
Schild MC3D Marine Seismic Survey	2012/6373	Not Controlled Action (Particular Manner)	Post-Approval
Schild Phase 11 MC3D Marine Seismic Survey, Browse Basin	2013/6894	Not Controlled Action (Particular Manner)	Post-Approval
Scott Reef Seismic Research	2006/2647	Not Controlled Action (Particular Manner)	Post-Approval
Searcher bathymetry & geochemical seismic survey, Brawse Basin,Timor Sea,WA	2013/6980	Not Controlled Action (Particular Manner)	Post-Approval
Sonar and Acoustic Trials	2001/345	Not Controlled Action (Particular Manner)	Post-Approval
Songa Venus Drilling and Testing Operations	2009/5122	Not Controlled Action (Particular Manner)	Post-Approval
Songa Venus Drilling Programme, Bonaparte Basin	2009/4990	Not Controlled Action (Particular Manner)	Post-Approval
Sunshine Infill 2D and Mimosa 2D Marine Seismic Surveys	2009/4699	Not Controlled Action (Particular Manner)	Post-Approval
Thoar 3D Marine Seismic Survey	2010/5668	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Tiffany 3D Seismic Survey	2010/5339	Not Controlled Action (Particular Manner)	Post-Approval
Torosa-5 Apraisal Well, WA-30-R	2008/4430	Not Controlled Action (Particular Manner)	Post-Approval
Tow West Atlas wreck from present location to boundary of EEZ	2010/5652	Not Controlled Action (Particular Manner)	Post-Approval
Tridacna 3D Ocean Bottom Cable Marine Seismic Survey	2011/5959	Not Controlled Action (Particular Manner)	Post-Approval
Ursa 3D Marine Seismic Survey	2008/4634	Not Controlled Action (Particular Manner)	Post-Approval
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval
Veritas Voyager 2D Marine Seismic Survey	2009/5151	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Woodside Southern Browse 3D Seismic Survey, WA	2007/3534	Not Controlled Action (Particular Manner)	Post-Approval
Zeemeermin MC3D seismic survey, Browse Basin, Offshore WA	2009/5023	Not Controlled Action (Particular Manner)	Post-Approval
Zeppelin 3D Seismic Survey	2011/6148	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			
3D Seismic Survey (NT/P68)	2006/2949	Referral Decision	Completed
Aurora extension MC3D Marine Seismic Survey	2011/5887	Referral Decision	Completed
BRSN08 3D Marine Seismic Survey	2008/4582	Referral Decision	Completed
Experimental Study of Behavioural and Physiological Impact on Fish of Seismic Ex	2006/2625	Referral Decision	Completed
Nova 3D Seismic Survey, WA 442-NT/P81, Joseph Bonaparte Gulf	2013/6820	Referral Decision	Completed
Pilot Appraisal Well - Torosa South-1	2008/3985	Referral Decision	Completed
Puffin South-West Development of Oil Reserves	2007/3834	Referral Decision	Completed
Seismic Data Acquisition, Browse Basin	2010/5475	Referral Decision	Completed

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Ancient coastline at 125 m depth contour	North-west
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	North-west
Canyons linking the Argo Abyssal Plain with the Scott Plateau	North-west
Carbonate bank and terrace system of the Sahul Shelf	North-west
Carbonate bank and terrace system of the Van Diemen Rise	North
Continental Slope Demersal Fish Communities	North-west
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	North-west
Pinnacles of the Bonaparte Basin	North
Pinnacles of the Bonaparte Basin	North-west

Name	Region
Seringapatam Reef and Commonwealth waters in the Scott Reef Complex	North-west
Shelf break and slope of the Arafura Shelf	North

Biologically Important Areas

[Resource Information]

Scientific Name	Behaviour	Presence
Dolphins		
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Breeding	Known to occur
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Calving	Known to occur
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Foraging	Known to occur
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Foraging (high density prey)	Known to occur
Orcaella heinsohni Australian Snubfin Dolphin [81322]	Resting	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Breeding	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Breeding	Likely to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Calving	Likely to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Calving	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Foraging	Likely to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Foraging	Known to occur
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Foraging (high density prey)	Likely to occur

Scientific Name	Behaviour	Presence
Sousa chinensis Indo-Pacific Humpback Dolphin [50]	Foraging (high density prey)	Known to occur
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Known to occur
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Calving	Known to occur
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Foraging	Known to occur
Dugong		
Dugong dugon Dugong [28]	Breeding	Known to occur
Dugong dugon Dugong [28]	Calving	Known to occur
Dugong dugon Dugong [28]	Foraging	Known to occur
Dugong dugon Dugong [28]	Foraging (high density seagrass beds)	Known to occur
Dugong dugon Dugong [28]	Nursing	Known to occur
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Likely to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Likely to occur

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Likely to occur
Chelonia mydas Green Turtle [1765]	Mating	Likely to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Likely to occur
Dermochelys coriacea Leatherback Turtle [1768]	Internesting	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Foraging	Known to occur
Lepidochelys olivacea Olive Ridley Turtle [1767]	Internesting	Likely to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur

Scientific Name	Behaviour	Presence
[Natator depressus](#) Flatback Turtle [59257]	Internesting	Likely to occur
[Natator depressus](#) Flatback Turtle [59257]	Internesting buffer	Known to occur
River shark		
[Pristis clavata](#) Dwarf Sawfish [68447]	Foraging	Known to occur
[Pristis zijsron](#) Green Sawfish [68442]	Foraging	Known to occur
Seabirds		
[Ardenna tenuirostris](#) Short-tailed Shearwater [84292]	Breeding	Known to occur
[Fregata ariel](#) Lesser Frigatebird [1012]	Breeding	Known to occur
[Fregata minor](#) Greater Frigatebird [1013]	Breeding	Known to occur
[Onychoprion anaethetus](#) Bridled Tern [82845]	Breeding	Known to occur
[Phaethon lepturus](#) White-tailed Tropicbird [1014]	Breeding	Known to occur
[Sterna dougallii](#) Roseate Tern [817]	Breeding	Known to occur
[Sternula albifrons sinensis](#) Little Tern [82850]	Breeding	Known to occur
[Sternula albifrons sinensis](#) Little Tern [82850]	Resting	Known to occur
[Sula leucogaster](#) Brown Booby [1022]	Breeding	Known to occur
[Sula sula](#) Red-footed Booby [1023]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Thalasseus bergii Crested Tern [83000]	Breeding	Known to occur
Thalasseus bergii Crested Tern [83000]	Breeding (high numbers)	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Calving	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Nursing	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Resting	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Appendix C2 – PMST results for Prelude Activity Area

Australian Government

Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Activity Area

Report created: 29-May-2025

Summary

Details

- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat

Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	22
Listed Migratory Species:	34

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	65
Whales and Other Cetaceans:	23
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	1

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	22
Key Ecological Features (Marine):	1
Biologically Important Areas:	1
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Papasula abbotti		
Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
[Phaethon lepturus fulvus](#)		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
[Phaethon rubricauda westralis](#)		
Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Species or species habitat likely to occur within area
MAMMAL		
[Balaenoptera borealis](#)		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
[Balaenoptera musculus](#)		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
[Balaenoptera physalus](#)		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
[Caretta caretta](#)		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
[Chelonia mydas](#)		
Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
[Dermochelys coriacea](#)		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
[Eretmochelys imbricata](#)		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
[Lepidochelys olivacea](#)		
Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
[Natator depressus](#)		
Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
SHARK		

Scientific Name	Threatened Category	Presence Text
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Foraging, feeding or related behaviour likely to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Migratory Marine Species		

Scientific Name	Threatened Category	Presence Text
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Foraging, feeding or related behaviour likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
[Phaethon lepturus](#) White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
[Phaethon lepturus fulvus](#) Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Fish		
[Bhanotia fasciolata](#) Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
[Campichthys tricarinatus](#) Three-keel Pipefish [66192]		Species or species habitat may occur within area
[Choeroichthys brachysoma](#) Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
[Choeroichthys suillus](#) Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
[Corythoichthys amplexus](#) Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
[Corythoichthys flavofasciatus](#) Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
[Corythoichthys intestinalis](#) Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
[Corythoichthys schultzi](#) Schultz's Pipefish [66205]		Species or species habitat may occur within area
[Cosmocampus banneri](#) Roughridge Pipefish [66206]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptile		

Scientific Name	Threatened Category	Presence Text
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus laevis Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
Aipysurus mosaicus as Aipysurus eydouxii Mosaic Sea Snake [87261]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hydrophis coggeri Cogger's Sea Snake, Black-headed Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
[Peponocephala electra](#) Melon-headed Whale [47]		Species or species habitat may occur within area
[Physeter macrocephalus](#) Sperm Whale [59]		Species or species habitat may occur within area
[Pseudorca crassidens](#) False Killer Whale [48]		Species or species habitat likely to occur within area
[Stenella attenuata](#) Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
[Stenella coeruleoalba](#) Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
[Stenella longirostris](#) Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
[Steno bredanensis](#) Rough-toothed Dolphin [30]		Species or species habitat may occur within area
[Tursiops aduncus](#) Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
[Tursiops aduncus (Arafura/Timor Sea populations)](#) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
[Tursiops truncatus s. str.](#) Bottlenose Dolphin [68417]		Species or species habitat may occur within area
[Ziphius cavirostris](#) Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Habitat Critical to the Survival of Marine Turtles		[Resource Information]
Scientific Name	Behaviour	Presence
Oct - Mar		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur

Extra Information

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260		Completed
Controlled action			
Develop Ichthys gas-condensate field permit area W	2006/2767	Controlled Action	Completed
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Prelude Floating Liquefied Natural Gas Facility and Gas Field Development	2008/4146	Controlled Action	Post-Approval
Not controlled action			
Adele Trend TQ3D Seismic Survey	2001/252	Not Controlled Action	Completed
Drilling of 12 Hydrocarbon Exploration Wells, Permit Area WA-371-P	2006/3005	Not Controlled Action	Completed
Kaleidoscope exploration well	2001/182	Not Controlled Action	Completed
Not controlled action (particular manner)			
2D seismic survey in permit areas WA-274P and WA-281P	2004/1521	Not Controlled Action (Particular Manner)	Post-Approval
Aurora MC3D Marine Seismic Survey	2010/5510	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Caswell MC3D Marine Seismic Survey	2012/6594	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Campaign	2011/6047	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Campaign, Browse Basin, WA-341-P, AC-P36 and WA-343-P	2013/6898	Not Controlled Action (Particular Manner)	Post-Approval
Gicea 3D Marine Seismic Survey	2008/4389	Not Controlled Action (Particular Manner)	Post-Approval
Ichthys 3D Marine Seismic Survey	2010/5550	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Schild Phase 11 MC3D Marine Seismic Survey, Browse Basin	2013/6894	Not Controlled Action (Particular Manner)	Post-Approval
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
BRSN08 3D Marine Seismic Survey	2008/4582	Referral Decision	Completed
Seismic Data Acquisition, Browse Basin	2010/5475	Referral Decision	Completed

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Continental Slope Demersal Fish Communities	North-west

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Sharks		
Rhincodon typus		
Whale Shark [66680]	Foraging	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Appendix C3 – PMST results for Light Assessment Area

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 12-Aug-2025

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	3
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	28
Listed Migratory Species:	48

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	82
Whales and Other Cetaceans:	26
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1
Habitat Critical to the Survival of Marine Turtles:	1

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	56
Key Ecological Features (Marine):	2
Biologically Important Areas:	8
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Papasula abbotti		
Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Phaethon rubricauda westralis		
Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Species or species habitat known to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
MAMMAL		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Aipysurus apraefrontalis		
Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama		
Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus fuscus		
Dusky Sea Snake [1119]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
[Eretmochelys imbricata](#) Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
[Lepidochelys olivacea](#) Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
SHARK		
[Carcharodon carcharias](#) White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
[Glyphis garricki](#) Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
[Pristis pristis](#) Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
[Pristis zijsron](#) Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
null		
Balaenoptera omurai		
Omura's Whale [87136]		Species or species habitat likely to occur within area
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Foraging, feeding or related behaviour likely to occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		Species or species habitat known to occur within area
Phaethon rubricauda		
Red-tailed Tropicbird [994]		Species or species habitat known to occur within area
Sula sula		
Red-footed Booby [1023]		Breeding known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata		
Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Terrestrial Species		
Cecropis daurica		
Red-rumped Swallow [80610]		Species or species habitat may occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Acrocephalus orientalis		
Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area
Thalasseus bergii		
Greater Crested Tern [83000]		Breeding known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Acrocephalus orientalis		
Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area overfly marine area
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area overfly marine area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Species or species habitat known to occur within area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
[Sula sula](#) Red-footed Booby [1023]		Breeding known to occur within area
[Thalasseus bergii as Sterna bergii](#) Greater Crested Tern [83000]		Breeding known to occur within area
Fish		
[Bhanotia fasciolata](#) Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
[Campichthys tricarinatus](#) Three-keel Pipefish [66192]		Species or species habitat may occur within area
[Choeroichthys brachysoma](#) Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
[Choeroichthys suillus](#) Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
[Corythoichthys amplexus](#) Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
[Corythoichthys flavofasciatus](#) Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
[Corythoichthys intestinalis](#) Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
[Corythoichthys schultzi](#) Schultz's Pipefish [66205]		Species or species habitat may occur within area
[Cosmocampus banneri](#) Roughridge Pipefish [66206]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptile		

Scientific Name	Threatened Category	Presence Text
Aipysurus apraefrontalis Short-nosed Sea Snake, Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Sea Snake, Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat may occur within area
Aipysurus fuscus Dusky Sea Snake [1119]	Endangered	Species or species habitat known to occur within area
Aipysurus laevis Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
Aipysurus mosaicus as Aipysurus eydouxii Mosaic Sea Snake [87261]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis coggeri Cogger's Sea Snake, Black-headed Sea Snake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis stokesii as Astrotia stokesii		
Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Hydrophis zweifeli as Enhydrina schistosa		
Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area
Lepidochelys olivacea		
Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera omurai		
Omura's Whale [87136]		Species or species habitat likely to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis		
Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks	[Resource Information]
Park Name	Zone & IUCN Categories
Kimberley	Multiple Use Zone (IUCN VI)

Habitat Critical to the Survival of Marine Turtles		[Resource Information]
Scientific Name	Behaviour	Presence
Oct - Mar		

Scientific Name	Behaviour	Presence
Chelonia mydas		
Green Turtle [1765]	Nesting	Known to occur

Extra Information

State and Territory Reserves		[Resource Information]
Protected Area Name	Reserve Type	State
Browse Island	Nature Reserve	WA
Unnamed WA41775	5(1)(h) Reserve	WA

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Boskalis Cambridge Gulf Marine Sand Sourcing Project	2025/10106		Referral Decision
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260		Completed
Marine Route Survey for Subsea Fibre Optic Data Cable System - Australia West	2024/09826		Completed
Controlled action			
2-D seismic survey Scott Reef	2000/125	Controlled Action	Post-Approval
Conduct an exploration drilling campaign	2010/5718	Controlled Action	Completed
Develop Ichthys gas-condensate field permit area W	2006/2767	Controlled Action	Completed
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Prelude Floating Liquefied Natural Gas Facility and Gas Field Development	2008/4146	Controlled Action	Post-Approval
Not controlled action			

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
3D marine seismic survey in WA 314P and WA 315P	2004/1927	Not Controlled Action	Completed
Adele Trend TQ3D Seismic Survey	2001/252	Not Controlled Action	Completed
Drilling of 12 Hydrocarbon Exploration Wells, Permit Area WA-371-P	2006/3005	Not Controlled Action	Completed
Echuca Shoals-2 Exploration of Appraisal Well	2006/3020	Not Controlled Action	Completed
Kaleidoscope exploration well	2001/182	Not Controlled Action	Completed
Marine Seismic Survey in WA-239-P	2000/24	Not Controlled Action	Completed
P30 Hydrocarbon Exploration Well	2001/293	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Not controlled action (particular manner)			
2 (3D) Marine Seismic Surveys	2009/4994	Not Controlled Action (Particular Manner)	Completed
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey of Braveheart,Kurrajong,Sunshine and Crocodile	2006/2917	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Marine Survey	2001/363	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey in permit areas WA-274P and WA-281P	2004/1521	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey, Permit AC/P 23	2005/2364	Not Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		(Particular Manner)	
3D Seismic Survey, Browse Basin, WA	2009/5048	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, near Scott Reef, Browse Basin	2005/2126	Not Controlled Action (Particular Manner)	Post-Approval
AC/P37 3D Seismic Survey Ashmore Cartier	2007/3774	Not Controlled Action (Particular Manner)	Post-Approval
Aurora MC3D Marine Seismic Survey	2010/5510	Not Controlled Action (Particular Manner)	Post-Approval
Bassett 3D Marine Seismic Survey	2010/5538	Not Controlled Action (Particular Manner)	Post-Approval
Braveheart 2D Infill Marine Seismic Survey 100km offshore	2008/4442	Not Controlled Action (Particular Manner)	Post-Approval
Braveheart 2D Marine Seismic Survey	2005/2322	Not Controlled Action (Particular Manner)	Post-Approval
Canis 3D Marine Seismic Survey	2008/4492	Not Controlled Action (Particular Manner)	Post-Approval
Cartier East and Cartier West 3D Marine Seismic Surveys	2009/5230	Not Controlled Action (Particular Manner)	Post-Approval
Caswell MC3D Marine Seismic Survey	2012/6594	Not Controlled Action (Particular Manner)	Post-Approval
Conduct an exploration drilling campaign	2011/5964	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Drilling of Exploration & Appraisal Wells Braveheart-1 & Cornea-3	2009/5160	Not Controlled Action (Particular Manner)	Post-Approval
Endurance 3D Marine Seismic Data Acquisition Survey	2007/3667	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Campaign	2011/6047	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Campaign, Browse Basin, WA-341-P, AC-P36 and WA-343-P	2013/6898	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Program - Permit areas - WA-314-P, WA-315-P, WA-398-P.	2008/4064	Not Controlled Action (Particular Manner)	Post-Approval
Gicea 3D Marine Seismic Survey	2008/4389	Not Controlled Action (Particular Manner)	Post-Approval
Ichthys 3D Marine Seismic Survey	2010/5550	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval
Kraken, Lusca & Asperus 3D Marine Seismic Survey	2013/6730	Not Controlled Action (Particular Manner)	Post-Approval
Octantis 3D Marine Seismic Survey, Permit Area AC/P41 off northern Western Australia	2007/3369	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Exploration Drilling Campaign	2011/6222	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to	2014/7223	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Darwin NT		Manner)	
Offshore Gas Exploration Drilling Campaign	2012/6384	Not Controlled Action (Particular Manner)	Post-Approval
Schild MC3D Marine Seismic Survey	2012/6373	Not Controlled Action (Particular Manner)	Post-Approval
Schild Phase 11 MC3D Marine Seismic Survey, Browse Basin	2013/6894	Not Controlled Action (Particular Manner)	Post-Approval
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed
Aurora extension MC3D Marine Seismic Survey	2011/5887	Referral Decision	Completed
BRSN08 3D Marine Seismic Survey	2008/4582	Referral Decision	Completed
Seismic Data Acquisition, Browse Basin	2010/5475	Referral Decision	Completed

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Ancient coastline at 125 m depth contour	North-west
Continental Slope Demersal Fish Communities	North-west

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Marine Turtles		

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Foraging	Likely to occur
Seabirds		
Ardenna tenuirostris Short-tailed Shearwater [84292]	Breeding	Known to occur
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur
Fregata minor Greater Frigatebird [1013]	Breeding	Known to occur
Phaethon lepturus White-tailed Tropicbird [1014]	Breeding	Known to occur
Sula sula Red-footed Booby [1023]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Appendix C4 – PMST results for Noise Assessment Area.

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 12-Aug-2025

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	22
Listed Migratory Species:	36

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	66
Whales and Other Cetaceans:	24
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	1

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	24
Key Ecological Features (Marine):	1
Biologically Important Areas:	1
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name	Buffer Status
Commonwealth Marine Areas (EPBC Act)	In feature area
Commonwealth Marine Areas (EPBC Act)	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anous tenuirostris melanops			
Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris canutus			
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Papasula abbotti			
Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Phaethon lepturus fulvus			
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area	In feature area
Phaethon rubricauda westralis			
Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Species or species habitat likely to occur within area	In feature area
MAMMAL			
Balaenoptera borealis			
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Balaenoptera musculus			
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
Balaenoptera physalus			
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			
Caretta caretta			
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area	In feature area
Chelonia mydas			
Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Dermochelys coriacea			
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area	In feature area
Eretmochelys imbricata			
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Lepidochelys olivacea			
Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area	In feature area
Natator depressus			
Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area	In feature area
SHARK			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area	In feature area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area	In feature area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area	In feature area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat may occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
null			
Balaenoptera omurai Omura's Whale [87136]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Birds			
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area	In feature area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area	In feature area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area	In feature area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Phaethon lepturus](#) White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area	In feature area
[Phaethon rubricauda](#) Red-tailed Tropicbird [994]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			
[Anoxypristis cuspidata](#) Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area	In feature area
[Balaenoptera borealis](#) Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Balaenoptera edeni](#) Bryde's Whale [35]		Species or species habitat likely to occur within area	In feature area
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
[Balaenoptera physalus](#) Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Carcharhinus longimanus](#) Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area	In feature area
[Carcharias taurus](#) Grey Nurse Shark [64469]		Species or species habitat may occur within area	In feature area
[Carcharodon carcharias](#) White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area	In feature area
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area	In feature area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area	In feature area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area	In feature area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area	In feature area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In feature area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat may occur within area	In feature area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In feature area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area	In feature area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area	In feature area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area	In feature area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area	In feature area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area	In feature area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area	In feature area
Phaethon rubricauda Red-tailed Tropicbird [994]		Species or species habitat likely to occur within area	In feature area
Fish			
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area	In feature area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area	In feature area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area	In feature area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area	In feature area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area	In feature area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area	In feature area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area	In feature area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area	In feature area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area	In feature area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area	In feature area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area	In feature area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area	In feature area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area	In feature area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area	In feature area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area	In feature area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area	In feature area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area	In feature area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area	In feature area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area	In feature area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area	In feature area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area	In feature area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area	In feature area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area	In feature area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area	In feature area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Solenostomus cyanopterus](#) Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area	In feature area
[Syngnathoides biaculeatus](#) Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area	In feature area
[Trachyrhamphus bicoarctatus](#) Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area	In feature area
[Trachyrhamphus longirostris](#) Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area	In feature area
Reptile			
[Aipysurus duboisii](#) Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area	In feature area
[Aipysurus laevis](#) Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area	In feature area
[Aipysurus mosaicus as Aipysurus eydouxii](#) Mosaic Sea Snake [87261]		Species or species habitat may occur within area	In feature area
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area	In feature area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area	In feature area
[Emydocephalus annulatus](#) Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Hydrophis coggeri Cogger's Sea Snake, Black-headed Sea Snake [25925]		Species or species habitat may occur within area	In feature area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area	In feature area
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area	In feature area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area	In feature area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area	In feature area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area	In feature area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area	In feature area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area	In feature area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area	In feature area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area	In feature area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Whales and Other Cetaceans			[Resource Information]
Current Scientific Name	Status	Type of Presence	Buffer Status
Mammal			
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area	In feature area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
Balaenoptera omurai Omura's Whale [87136]		Species or species habitat likely to occur within area	In feature area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area	In feature area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area	In feature area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area	In feature area

Current Scientific Name	Status	Type of Presence	Buffer Status
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area	In feature area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area	In feature area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area	In feature area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In feature area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In feature area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area	In feature area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area	In feature area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area	In feature area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area	In feature area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area	In feature area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area	In feature area

Current Scientific Name	Status	Type of Presence	Buffer Status
Steno bredanensis			
Rough-toothed Dolphin [30]		Species or species habitat may occur within area	In feature area
Tursiops aduncus			
Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area	In feature area
Tursiops aduncus (Arafura/Timor Sea populations)			
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area	In feature area
Tursiops truncatus s. str.			
Bottlenose Dolphin [68417]		Species or species habitat may occur within area	In feature area
Ziphius cavirostris			
Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area	In feature area

Habitat Critical to the Survival of Marine Turtles			[Resource Information]
Scientific Name	Behaviour	Presence	Buffer Status
Oct - Mar			
Chelonia mydas			
Green Turtle [1765]	Nesting	Known to occur	In feature area

Extra Information

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260		Completed	In feature area
Controlled action				
Develop Ichthys gas-condensate field permit area W	2006/2767	Controlled Action	Completed	In feature area
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed	In feature area
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Prelude Floating Liquefied Natural Gas Facility and Gas Field Development	2008/4146	Controlled Action	Post-Approval	In feature area
Not controlled action				
Adele Trend TQ3D Seismic Survey	2001/252	Not Controlled Action	Completed	In feature area
Drilling of 12 Hydrocarbon Exploration Wells, Permit Area WA-371-P	2006/3005	Not Controlled Action	Completed	In feature area
Kaleidoscope exploration well	2001/182	Not Controlled Action	Completed	In buffer area only
P30 Hydrocarbon Exploration Well	2001/293	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
2D seismic survey in permit areas WA-274P and WA-281P	2004/1521	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Aurora MC3D Marine Seismic Survey	2010/5510	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Caswell MC3D Marine Seismic Survey	2012/6594	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Exploration Drilling Campaign	2011/6047	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Exploration Drilling Campaign, Browse Basin, WA-341-P, AC-P36 and WA-343-P	2013/6898	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Gicea 3D Marine Seismic Survey	2008/4389	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Ichthys 3D Marine Seismic Survey	2010/5550	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Schild MC3D Marine Seismic Survey	2012/6373	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Schild Phase 11 MC3D Marine Seismic Survey, Browse Basin	2013/6894	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Referral decision				
BRSN08 3D Marine Seismic Survey	2008/4582	Referral Decision	Completed	In feature area
Seismic Data Acquisition, Browse Basin	2010/5475	Referral Decision	Completed	In feature area

Key Ecological Features [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region	Buffer Status
Continental Slope Demersal Fish Communities	North-west	In feature area

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence	Buffer Status
Sharks			
Rhincodon typus			
Whale Shark [66680]	Foraging	Known to occur	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data is available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on the contents of this report.

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions when time permits.

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded breeding sites; and
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Appendix D Oil Spill Modelling - RPS Technical Note

Appendix B.7 a) Technical note - RPS

Response to Inpex questions on Oil Spill Modelling

The following technical guidance has been prepared by me, Scott Langtry, as a subject matter expert in oil spill modelling as applied to environmental management of oil field operations within the offshore waters of Australia. The details provided constitute my opinions based on specialised knowledge developed through my education, training, study, and experience, including working experience carrying out oil spill modelling for risk assessment and response to real spill incidents over 26 years.

This report has been compiled in response to a request by Inpex Australia to provide answers to the following questions:

1.0 Base Scope

Question	Answer
a) Describe generally the purpose of oil spill modelling.	See addendum, Section 1.0.
b) Develop a report which describes the model conservatism, and how the conservatisms affect model outputs and results, as related to the thresholds presented in (c) and (d) below.	See addendum, Section 2.0 and details below.
c) 10 ppb entrained oil threshold:	
(i) Can you confirm that the 10 ppb entrained threshold, when evaluated through the model, is based on ‘instantaneous exposure”, when the 10 ppb threshold is actually derived from dissolved oil exposure over a time-weighted average?	Yes. The model calculations are analysed for distributions of oil mass in different states (floating, entrained, dissolved, stranded, evaporated) at each model time step. Typically, 15-minute time steps (or less) are used to maximise accuracy of the weathering and transport calculations. Consequently, entrained oil >10 ppb (parts per billion) calculated for durations as short as 15 minutes during any replicate simulation would flag a location as ‘affected’. This flag would only need to occur during 1 of 300 simulations (=0.3% probability of occurrence) for that location to be enclosed by a polygon defining the

	Environment that May Be Affected (EMBA) as defined in the NOPSEMA guideline (2019). A 10 ppb entrained threshold is not based on evidence that 10 ppb of entrained oil droplets (alone) is harmful for either short term (e.g., 15 minutes or for any longer duration (e.g., 48-96 hrs). The NOPSEMA guideline has applied the same threshold for both dissolved and entrained hydrocarbon concentrations as instantaneous exposures. The dissolved threshold concentration was calculated by toxicity studies applying long-term exposures (48-96 hrs of exposure) to the components of oil that can dissolve into water from oil mixtures and no correction for shorter exposure durations has been applied in the NOPSEMA guidelines (see below; part ii). At the outer bounds of the EMBA calculated for a blowout simulation spanning 70 or more days, entrained oil would be present as widely dispersed and insoluble droplets with small diameter (10-50 µm). No insoluble compounds will remain to dissolve into the water to trigger the toxic effects demonstrated by toxicity testing on marine organisms. Direct contact with droplets or consumption of droplets may have influence but risks of influence would depend upon encounter rates, which would depend on the concentration of droplets and the duration that they are present. As an indication of the meaning of the 10 ppb concentration threshold that the NOPSEMA guidelines recommend for entrained oil, this would represent one insoluble droplet suspended in 40,000 L of water for a droplet of 25 µm diameter. It would be necessary to have one million droplets of this size to form a standard drop of oil from an oil dropper (0.05 ml). Consequently, the potential for direct contact by marine biota with a droplet at this threshold concentration when triggered by durations as short as 15 minutes is highly conservative for any consequence through direct contact with droplets.
(ii) Can you describe how the use of instantaneous thresholds in the model may affect the model outputs/geographical areas exposed above threshold?	Instantaneous thresholds have a very large influence upon the geographic extent that is mapped as the EMBA, an influence larger than all other conservative measures applied. Hydrocarbons impose a narcotic effect on organisms through absorption of soluble hydrocarbons from water into their tissue, and it takes longer than 15 minutes for

	harmful soluble compounds to accumulate to levels that impose effect when the concentration of harmful, soluble, hydrocarbons in the water is higher than 10 ppb. Species vary by sensitivity and different oils vary in terms of the toxic components present. The lowest toxic threshold for soluble hydrocarbons (~10 ppb) has been derived as a generic trigger value for potential sublethal influence from a large body of laboratory toxicity testing where exposure has been maintained for 48-96 hrs to ensure saturation of body tissues. A value of ~10 ppb is the lowest value reported for the most sensitive marine species using the water solutions generated from the most toxic oil mixtures. Exponentially higher concentrations are required to achieve equivalent effects over shorter durations. At least 100 times higher concentrations would remain conservative for durations of <1 hr. Instantaneous thresholds treat all areas exposed for a time as short as 15 minutes as if they were exposed constantly for 2 to 4 days (following evidence from toxicity studies). This is very conservative, and reliance on the extent of the EMBA alone obscures information that would be available to show those locations that may be more at risk, such as those locations where longer exposures may occur. Further clarification can be provided.
(iii) Can you comment on how the probability maps/contours generated by the model using instantaneous oil exposure thresholds would be affected, compared to what would occur using time-weighted exposure thresholds?	Comparisons of model calculations for areas that might experience instantaneous exposures (e.g., >10 ppb of entrained oil for 15 minutes) versus time-weighted exposures (e.g., >10 ppb on average over 24, 48 or 96 hours) indicates that the difference depends on the scenario, oil type and component (floating, entrained, dissolved). The outer extent of the EMBA may be reduced to as small as 20% of the surface area (i.e., the surface area enclosed by the EMBA may be reduced by up to 80%) when based on time-weighted exposures. The shape of the EMBA will also typically change to highlight locations where environmental forcing is more likely to direct higher concentrations of spilled material repeatedly or to retain spilled material for longer during a long duration release (e.g., a blowout) – detail that should be relevant to risk assessment, planning and consultation purposes.

	Allowing for as little as 2 subsequent time steps or for 2 records of exceedance at any time during any spill simulation, will result in marked reduction of the geographic area and alter the shape calculated for the EMBA, showing that large parts of the existing EMBA calculations can be due to single, 15-minute, records. Further clarification can be provided.
c) 10 g/m^2 shoreline contact threshold:	
(i) Can you describe how the model calculates oil accumulation volumes on shorelines, in consideration of the modelled shoreline grid-cell/lineal shoreline lengths vs actual/realistic shoreline lengths and the effect this may have on volumes of oil ashore calculated by the model?	Accumulation of oil onto shorelines is calculated as the mass of oil per unit of shoreline area. The coastline at mean sea level is subdivided into fixed, rectangular, grid cells of a defined area described by fixed length and width. For example: • 1 km long x 10 m wide (10,000 m^2 area per cell) for blowouts. • 400 m long x 10 m wide (4,000 m^2 area per cell) for diesel spills. Owing to the grid scale applied, the coastline shape must be simplified in areas of small-scale complexity. Very complex and convoluted shorelines will be represented by a smaller area than reality, adding conservatism by lowering the area used when calculating the mass of oil per unit area. The more complex the coastline the larger the degree of conservatism. If the model calculates that any part of a patch of floating oil contacts any part of a coastline cell, the total mass of oil in that patch is transferred to the coastline cell as a conservative calculation for oil stranding. Any subsequent oil patches that contact that coastline cell will add to the tally in that coastline cell over time. The maximum possible load at any time will be capped at the carrying capacity set for shoreline cells (40 m^3 over 10,000 m^2 for low viscosity oils (condensates and diesel, etc.). Any excess oil will be re-floated and may then accumulate on other coastline cells. Evaporation and degradation are calculated for stranded oil to reduce the tally of oil in a coastline cell over time.

	When all simulations are complete, the highest mass recorded at any time due to inputs versus losses is found for each coastline cell in each simulation. The highest mass from any simulation is divided by the shoreline area of the cell to determine the peak concentration (grams of oil/area in m^2) as the most conservative calculation for the amount of oil that might be present, for clean-up and other considerations. The peak concentration calculated for each shoreline cell among all replicate simulations is compared to thresholds of relevance. Any shoreline cell with peak mass per area > minimum threshold (e.g., 10 g/m^2) during any replicate simulation will be included in the EMBA polygon. Note that: 1. The peak concentration that is calculated will be higher if the surface area available for accumulation is under-represented in the model compared to reality. 2. The peak concentration that is calculated may be, and typically is, higher than the concentration that would be calculated at the end of the simulation, after further weathering is allowed for. 3. No differential is made between oil on the surface and oil that has entered the substrate. Further clarification can be provided.
(ii) Can you describe if the model includes consideration of tidal movements or wetting and drying of intertidal areas, and how this may affect modelled oil concentration outputs, vs what might occur in reality?	The model does not account for wetting and drying of the intertidal zone. Both the coastline position and water level are treated as fixed, and calculations assume a fixed average width of the shoreline interface (10 m wide) is always available for accumulation. One outcome at a very local scale is that the model cannot differentiate between the happenstance of oil arriving when the shoreline extends further seaward (at lower tide, exposing a wider zone) or when it might have shrunk back to a narrower zone (at higher tide). Although the intertidal width will vary over time, in reality, and oil might be spread over varying area, the area allowance is assumed fixed to an average of 10 m wide when calculating the mass accumulated per area. In reality, concentrations of oil would likely vary with the tide in areas with very large tidal ranges and low slope,

	and we have applied a fixed width as an assumed average. One conservatism is that shorelines are assumed to be "sticky" – binding the oil to the shorelines with no re-floating due to subsequent tidal flooding. This assumes oil accumulations would migrate up and down, occupying the same width of the shoreline as the tide varied. The exception is if the carrying capacity of the shoreline is exceeded. For condensates and diesel this would only be allowed in the model if the thickness exceeded 4 mm, allowing for high accumulation capacity (e.g., 32 tons per shoreline cell for a 1 km long x 10 m wide shoreline if the density averaged 800 kg/m^3). Noting that the model domain must cover areas of hundreds of thousands of km^2 for a blowout scenario, the fixed coastline assumptions represent necessary simplifications requiring a conservative approach. Further clarification can be provided.
(iii) Can you confirm if the model continues to calculate oil weathering of stranded oil on a shoreline, specifically evaporation and melting point?	Yes. As stated above (part i), oil weathering continues to apply to oil classed as stranded. Loss of oil mass from coastline cells can occur through three processes: 1. Evaporation. 2. Degradation (representing microbial action and photo-oxidation). 3. Re-floating (if the carrying capacity of the coastline cell is exceeded). The composition of the oil when freshly released at source is represented by the proportion of the whole oil contributed by groups of hydrocarbons, varying by volatility. Composition change is calculated over time through evaporation and dissolution when the oil is floating, and the composition of oil patches is known by the model at the time of stranding. Calculations for variable rates of evaporation, by sub-components, continues for stranded oil until only the non-evaporating residues (boiling point >380 °C) remain. Calculations for evaporation rates are based on wind speed and average ambient temperature (30 °C for the Inpex studies), not elevated temperatures that might occur during daytime on heat-retaining surfaces.

	Calculations for evaporation are, therefore, conservative if evaporating components remain in the stranded oil. If only residues strand, no loss of oil through evaporation will be calculated on shorelines. Degradation is applied to the total mass (regardless of composition) at a fixed rate. A conservative rate of 3% of the mass per day is applied. This rate has been derived from published tests on more complex oil types than diesel or condensate and is considered conservative for condensates in lieu of further research to confirm rates of degradation of both oil types. The model does not calculate for melting point to decide whether the oil is on the substrate (e.g., as solid wax) or in the substrate (e.g., as a melted wax).
(iv) Can you describe if the model takes into consideration the effect of exposed intertidal shoreline temperature (i.e., sand/rock temperature) and the effect this may have on stranded oil including effect on oil melting point and subsequent behaviour of the stranded oil?	Degradation rates do not account for substrate temperature. This will be conservative in settings with high average substrate temperatures because degradation rates do increase at higher temperatures. The same ambient temperature and prevailing wind speeds are used for both floating and stranded oil for calculating evaporation rates. This will be conservative if the oil arrives with volatile content and the real temperatures are higher than assumed (30°C for the Inpex study locations) on average. This would not be conservative if only residues arrive at coastline cells. No calculations are made by the model for the physical state (solid/liquid) of hydrocarbons, or of uptake by sediments. Such considerations would need to be made outside of the model calculations. Further clarification can be provided.

1.1 Supplementary Scope

(a) Can you confirm if there are any other factors which may affect conservatisms within the model?	See addendum.
(b) if Yes, can you please explain these additional factors.	See addendum.

Addendum

1.0 (a) Describe generally the purpose of oil spill modelling.

Modelling of oil fate and transport is useful, and has been applied to multiple purposes:

- Calculating risks of exposure to facilities, personnel, interests of other parties and environmental resources if a spill scenario were to eventuate.
- Guiding preparations for response, including identifying those resources that may need to be defended and what responses may be practical given factors such as the nature of the place at risk and the evolution through weathering of the oil type(s) that might be spilled.
- Forecasting the drift and behaviour of oil slicks ahead of real time to guide response to real spills.
- Forecasting the efficacy of alternative response measures.
- Guidance of environmental monitoring efforts to sense influence or impact.
- Post-spill assessment to inform and quantify social, environmental, or commercial impacts.

The first general application is the basis of EMBA calculations at present, but with the results simplified to calculating the area enclosing all locations where greater than low threshold concentrations might occur instantaneously at very low probabilities.

Other calculations from modelling are available and may be applied as contextual measures. These include:

- Mapping locations at higher probability of contact > instantaneous thresholds.
- Mapping locations at risk of longer durations of contact > instantaneous thresholds.
- Mapping locations at higher probability of contact at > time-integrated thresholds.
- Mapping locations based on potential concentrations (maximums and statistical distributions such as mean and higher percentiles).

1.0 (b) Develop a report which describes the model conservatism, and how the conservatisms affect model outputs and results, as related to the thresholds presented in (c) and (d) below.

General background

In general, oil spill models are a collection of interacting formulae and calculations that have been compiled to best represent current knowledge of processes that affect oil when released into the marine environment.

These processes are complex and interacting, requiring organised formulation to avoid errors and bias.

The formulations are numerical tools that allow comparative testing for different outcomes depending upon the scenario and prevailing conditions, subject to errors and uncertainties in both the inputs and the formulae.

Key processes have been studied to varying degrees over several decades through empirical studies, observations, and laboratory experiments. Some processes and their dependencies are well understood, while others have larger uncertainties and are the subject of ongoing testing and development.

The model formulations allow management of uncertainties through sensitivity allowances and/or conservative calculations or inputs (i.e., arrangements that are more likely to overstate and not understate risks).

Potential sources of conservatism

As a general principle, the ongoing calculation of concentrations over a large number of sequential time steps (e.g., 7,680 contiguous time-steps in an 80-day blowout simulation), with calculations at each time step dependent upon a previous calculation of state, can be expected to lead to magnification of any model errors at the outer distances and durations.

The current NOPSEMA guidance for calculating the EMBA has changed the focus of modelling assessment efforts from identifying locations that are most at risk (typically closer to the source and at risk of contact over shorter elapsed times) to map out only an outer bound of possibilities. One consequence of this is that the EMBA definition is now highly dependent on model capabilities, uncertainties, and compounding of errors in calculations for defining when concentrations will fall below very low concentrations.

The modelling software that I will detail to address model calculations and conservatism is the Spill Impact Model Application Package (SIMAP) that has been applied to most oil spill risk assessments in Australia, including those carried out for INPEX, but considerations will be common to other oil spill models of similar capability.

SIMAP is three-dimensional and is structured as a series of interacting algorithms that consider all known key processes that may affect the transport and weathering of hydrocarbon mixtures:

- Buoyancy (upward vertical transport from subsea).
- Initial spreading due to gravity and surface tension.
- Horizontal transport due to wind and current.
- Spreading (transport in the vertical and horizontal) due to dispersive forces.
- Wave-induced entrainment into the water column (as oil droplets).
- Dissolution (of soluble hydrocarbons) into the water column.
- Vertical dispersion of dissolved hydrocarbons (vertical spreading due to dispersive forces).
- Evaporation to the atmosphere.
- Emulsification (uptake of water into floating oil films).
- Change in viscosity due to change in composition and emulsification.
- Sedimentation (through binding with suspended sediment).
- Shoreline stranding – shoreline specific.
- Re-floating from shorelines (if capacity exceeded).
- Degradation (to component molecules).

The model uses oil composition and physical properties as input, and calculates changes in the mass distribution of the spilled oil over time among six states in response to the release scenario (e.g., onto the water, from subsea blowouts, etc.) and a sequence of environmental conditions:

1. Floating as a film on the water surface.

2. Entrained (at some depth) as oil droplets suspended in the water column.
3. Dissolved (at some depth) in the water column from films or suspended droplets.
4. Evaporated (to the atmosphere).
5. Stranded on a shoreline.
6. Degraded to simpler chemical components (hydrogen, carbons, etc.).

The NOPSEMA guidelines require that the worst-case (or worst plausible case) spill scenario is modelled for a given oilfield operation. For drilling operations into reservoirs where gas/condensates are targeted, that will involve a long-term (>70-day) release of gas and condensate at the highest rate possible through a fully open reservoir.

This scenario will generate the highest potential initial concentrations, both in reality and in the model, and is a conservative starting point.

Key considerations for conservatisms in the modelling are calculations for initial concentrations, the initial distribution of oil mass among the states, and processes that affect reductions in the concentrations of oil in each state over time.

Calculations for gas-condensate releases, more so than for heavier oil types, are very sensitive to model calculations of entrainment rates because these oil mixtures have both very low viscosity (hence will be susceptible to entrainment) and are mostly composed of volatile hydrocarbons (hence will be susceptible to evaporation, if exposed to the atmosphere). Entrainment and dissolution are competing fate pathway to floating and evaporation.

Over-prediction of entrainment rates will reduce the evaporation rate that is calculated (a general loss term for calculation of oil mass that would otherwise be on or in the water, or on shorelines) and leads to higher concentrations of entrained oil being calculated further from the source.

Entrainment is calculated for two processes by the model:

- As droplets released subsea (for blowouts).
- Generated by waves breaking up slicks into droplets and mixing the droplets into the surface layer, or keeping droplets that were entrained by the process above mixed into that layer.

Considerable care is required to calculate the initial droplet-size distributions accurately for subsea blowout scenarios involving highly volatile condensates (as opposed to less volatile mixtures) due to the large influence of droplet-size calculations upon entrainment rates versus evaporation rates. Calculations for oil droplet sizes have been an active area of model development and the modelling currently incorporates the most recent calculations from authoritative sources (SINTEF, TAMOC, etc.) but understatement of droplet sizes remains a risk for overstatement of entrainment rates because most research has involved heavier oil types.

Calculations for entrainment due to wave action in the SIMAP model were updated ~5 years ago to new formulations following a large volume of research conducted for the Deepwater Horizon blowout. The updated formulations increased the sensitivity to wave action, lowering thresholds for wind speed required to generate or maintain entrainment for low viscosity oils.

Sensitivity testing suggests that the allowances may be overly conservative for entrainment rates when applied to highly volatile condensates. In turn, calculations

would likely be conservative for dissolution rates and dissolved hydrocarbon concentrations for these products because faster dissolution is calculated for entrained oil than for slicks.

The model will calculate reduction of oil concentrations for surface and subsurface oil concentrations (entrained and dissolved) due to dispersion, representing the spreading and thinning of patches and plumes over time due to the mixing forces in the ocean.

Contemporary calculations for dispersion are typically set for moderate sea conditions for the scenario setting and not for more energetic conditions that can occur. On average, it is expected that this approach will result in maintenance of higher concentrations over longer distances than might occur in reality. The level of conservatism would vary depending on the frequency of occurrence of windy conditions that would trigger breaking sea waves.

A further level of conservatism for calculation of entrainment (increasing dissolution) versus floating (increasing evaporation) for surface releases of highly volatile condensates is the model time step. Highly volatile condensates with a low residue content will flash off rapidly, in reality, when spread thinly onto the water surface. However, calculation at 15-minute steps, which is a practical rate for long term blowout modelling, may underestimate the evaporation rate that is calculated for such condensates and overestimate the calculation for maintenance of entrained oil concentrations above low thresholds. Evaporation rates are calculated to occur at a slower rate for soluble hydrocarbons that are dissolved in surface-waters than at the surface, which could lead to overstatement of dissolved hydrocarbon concentrations exceeding low thresholds.

Some loss of mass is calculated for entrained oil over time due to dissolution of the soluble compounds. These compounds will typically represent a small proportion of the mass of an oil initially (typically 6-12% for condensates) so there would be only a relatively small influence on reduction of entrained oil concentrations.

It is also noteworthy that the model can calculate when entrained oil droplets have lost all soluble components. However, the NOPSEMA guidelines are applied equally to entrained oil that has remaining soluble components and those that have migrated long distances over long time periods and would have weathered to lose all soluble components. Because the EMBA line defines the widest boundaries, it will be the concentrations of weathered entrained oil that are tested against the NOPSEMA guideline threshold.

Degradation rates are applied to allow for reduction of oil concentrations over time. These rates are derived from literature accounts, and different rates are applied to floating, entrained, dissolved, and stranded oil. All rates are assumed to be conservative for condensates, in particular, because they tend to be composed of simpler hydrocarbons than those oils used to measure degradation rates, which could lead to concentrations being maintained for longer distances and durations than might occur, in reality, in warm tropical and sub-tropical settings. The rate currently applied to the insoluble components of entrained oil is a constant rate of ~8% of the mass per day.

Collectively for these uncertainties, calculations for entrainment mass concentrations and dissolved hydrocarbons will tend to be increasingly conservative over many sequential calculations.

The extremely low threshold set by the NOPSEMA guidelines for entrained oil is interacting with the conservative allowances for entrained concentrations for gas

condensates to dominate calculations for the EMBA for both blowout and surface release scenarios for this oil type. In other words, the extent of the entrained oil contour applied to the EMBA calculation is always larger than for any other component.

A further, potential, consequence of maintaining entrained concentrations for longer, in combination with the low threshold set by the NOPSEMA guidelines for oil contact with shorelines (as opposed to accumulation), is that model calculations for re-floating of oil from an entrained state become more critical. The model only needs to calculate that re-floating has led to a small patch of oil at the surface that is equal to or marginally higher than the low threshold (10 g/m^2 on the surface) from an overstated entrained oil concentration to flag a once-off calculation for shoreline exposure at a location that can be isolated by a long distance from the extent calculated for surface slicks to decrease below threshold concentrations when remaining at surface. One such occurrence among 300 simulations will flag a shoreline location for inclusion in the EMBA at a further distance than is indicated for the persistence of surface slicks above the low threshold. Although entrainment and re-floating are real processes that can occur, it is plausible that model errors are responsible for triggering the flagging of some stranding events judged by the low instantaneous threshold at the outer bounds of the EMBA.

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Appendix E Oil Spill Modelling for worst case scenarios

MAKING COMPLEX EASY

A TETRA TECH COMPANY

SHELL PRELUDE 5-YEAR REVISION OIL SPILL MODELLING

Annualised risk calculations

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1 SCENARIO 1: UNCONTROLLED PRODUCTION WELL RELEASE THROUGH THE 7" PRODUCTION TUBING

1.1 Floating Oil

Table 1.1 Potential for exposure to floating oil for individual sensitive receptors for Scenario 1. Annualised results.

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
Australian Marine Parks	Ashmore Reef MP	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Cartier Island MP	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Kimberley MP*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
Biologically Important Areas	Marine Turtle BIA	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Seabirds BIA	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Sharks BIA	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Whales BIA	< 1	< 1	< 1	< 1	NC	NC	NC	NC
Coastlines	Marnebulorgne Community N Point - Augereau Island (B)	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Scott Reef North	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Scott Reef South	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Seringapatam Reef	< 1	< 1	< 1	< 1	NC	NC	NC	NC
Exclusive Economic Zone	Australian Exclusive Economic Zone*	100	< 1	< 1	< 1	1	NC	NC	NC
	Indonesian Exclusive Economic Zone*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
Fisheries	North-West Slope Trawl Fishery*	100	< 1	< 1	< 1	1	NC	NC	NC
	Southern Bluefin Tuna Fishery	100	< 1	< 1	< 1	1	NC	NC	NC
	Western Skipjack Fishery	100	< 1	< 1	< 1	1	NC	NC	NC
	Western Tuna and Billfish Fishery	100	< 1	< 1	< 1	1	NC	NC	NC
IMCRA	Northwest Shelf*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Oceanic Shoals*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
IBRA	Timor Sea Coral Islands*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
Islands	Cartier Island	< 1	< 1	< 1	< 1	NC	NC	NC	NC
Key Ecological Features	Ancient Coastline at 125m Depth Contour*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Continental Slope Demersal Fish Communities*	25	< 1	< 1	< 1	25	NC	NC	NC

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	< 1	< 1	< 1	< 1	NC	NC	NC	NC
Nature Reserve	Scott Reef NR	< 1	< 1	< 1	< 1	NC	NC	NC	NC
Reefs, Shoals and Banks	Ashmore Reef	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Echuca Shoal*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Eugene McDermott Shoal*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Goeree Shoal*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Heywood Shoal*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Johnson Bank*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Sandy Islet	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Scott Reef North*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Scott Reef South	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Seringapatam Reef*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Vulcan Shoal*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Woodbine Bank*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
State Waters	Western Australia State Waters*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
WA Fisheries	Abalone*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Broome Prawn*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Kimberley Crab Fishery*	100	< 1	< 1	< 1	1	NC	NC	NC
	Kimberley Prawn*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	Mackerel Fishery*	100	< 1	< 1	< 1	1	NC	NC	NC
	Northern Demersal Scalefish*	100	< 1	< 1	< 1	1	NC	NC	NC
	South West Coast Salmon*	100	< 1	< 1	< 1	1	NC	NC	NC
	Specimen Shell*	< 1	< 1	< 1	< 1	NC	NC	NC	NC
	West Coast Deep Sea Crustacean*	100	< 1	< 1	< 1	1	NC	NC	NC

NC: No contact to receptor predicted for specified threshold. NA: Not applicable

* Floating oil will not accumulate on submerged features and at open ocean locations

1.2 Shoreline Oil Accumulation

Table 1.2 Potential for accumulation of oil onto shoreline receptors for Scenario 1. Annualised results. Calculations are for peak oil accumulation over time in any simulation for each receptor.

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
Australian Marine Parks	Ashmore Reef MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Cartier Island MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Kimberley MP*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Biologically Important Areas	Marine Turtle BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Seabirds BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Sharks BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	4	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Whales BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Coastlines	Marnebulorgne Community N Point - Augereau Island (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	4	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Scott Reef North	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Scott Reef South	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Exclusive Economic Zone	Australian Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Indonesian Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fisheries	North-West Slope Trawl Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Southern Bluefin Tuna Fishery	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	4	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Western Skipjack Fishery	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	4	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Western Tuna and Billfish Fishery	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	4	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
IMCRA	Northwest Shelf*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Oceanic Shoals*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
IBRA	Timor Sea Coral Islands*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Islands	Cartier Island	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
Key Ecological Features	Ancient Coastline at 125m Depth Contour*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Continental Slope Demersal Fish Communities*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nature Reserve	Scott Reef NR	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Ashmore Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Echuca Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Eugene McDermott Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Goeree Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Heywood Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Johnson Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sandy Islet	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Scott Reef North*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Scott Reef South	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Seringapatam Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Vulcan Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Woodbine Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
State Waters	Western Australia State Waters*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Abalone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Broome Prawn*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kimberley Crab Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kimberley Prawn*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mackerel Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Northern Demersal Scalefish*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	South West Coast Salmon*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Specimen Shell*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	West Coast Deep Sea Crustacean*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NC: No contact to receptor predicted for specified threshold. NA: Not applicable

* Floating oil will not accumulate on submerged features and at open ocean locations.

1.3 Entrained Oil

Table 1.3 Potential for exposure to entrained oil for individual sensitive receptors for Scenario 1. Annualised results.

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
Australian Marine Parks	Ashmore Reef MP	8.67	< 0.33	< 0.33	566	NC	NC	2	21
	Cartier Island MP	5	< 0.33	< 0.33	262	NC	NC	2	25
	Kimberley MP	9	< 0.33	< 0.33	259	NC	NC	3	28
Biologically Important Areas	Marine Turtle BIA	18	< 0.33	< 0.33	254	NC	NC	5	41
	Seabirds BIA	49	< 0.33	< 0.33	74	NC	NC	12	49
	Sharks BIA	59	< 0.33	< 0.33	48	NC	NC	13	69
	Whales BIA	42.67	< 0.33	< 0.33	88	NC	NC	10	39
Coastlines	Marnebulorgne Community N Point - Augereau Island (B)	26.67	< 0.33	< 0.33	149	NC	NC	7	52
	Scott Reef North	1.67	< 0.33	< 0.33	357	NC	NC	2	19
	Scott Reef South	2.33	< 0.33	< 0.33	703	NC	NC	2	19
	Seringapatam Reef	9.67	< 0.33	< 0.33	335	NC	NC	4	20
Exclusive Economic Zone	Australian Exclusive Economic Zone	100	100	< 0.33	1	2	NC	354	641
	Indonesian Exclusive Economic Zone	13.67	< 0.33	< 0.33	211	NC	NC	5	26
Fisheries	North-West Slope Trawl Fishery	100	100	< 0.33	1	2	NC	354	641
	Southern Bluefin Tuna Fishery	100	100	< 0.33	1	2	NC	354	641
	Western Skipjack Fishery	100	100	< 0.33	1	2	NC	354	641
	Western Tuna and Billfish Fishery	100	100	< 0.33	1	2	NC	354	641
IMCRA	Northwest Shelf	57.67	< 0.33	< 0.33	74	NC	NC	12	56
	Oceanic Shoals	18.33	< 0.33	< 0.33	134	NC	NC	5	50
IBRA	Timor Sea Coral Islands	18.33	< 0.33	< 0.33	208	NC	NC	5	42
Islands	Cartier Island	5	< 0.33	< 0.33	262	NC	NC	2	25
Key Ecological Features	Ancient Coastline at 125m Depth Contour	54.67	< 0.33	< 0.33	77	NC	NC	11	50
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	8.67	< 0.33	< 0.33	258	NC	NC	2	25
	Continental Slope Demersal Fish Communities	94.33	6.33	< 0.33	13	79	NC	51	132

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	9.67	< 0.33	< 0.33	298	NC	NC	4	20
Nature Reserve	Scott Reef NR	2.33	< 0.33	< 0.33	713	NC	NC	2	19
Reefs, Shoals and Banks	Ashmore Reef	8.67	< 0.33	< 0.33	566	NC	NC	2	21
	Echuca Shoal	1	< 0.33	< 0.33	1,372	NC	NC	2	11
	Eugene McDermott Shoal	1	< 0.33	< 0.33	614	NC	NC	<1	16
	Goeree Shoal	4.33	< 0.33	< 0.33	274	NC	NC	2	16
	Heywood Shoal	9.67	< 0.33	< 0.33	328	NC	NC	4	31
	Johnson Bank	2	< 0.33	< 0.33	754	NC	NC	2	12
	Sandy Islet	2.33	< 0.33	< 0.33	703	NC	NC	2	13
	Scott Reef North	3.33	< 0.33	< 0.33	346	NC	NC	2	16
	Scott Reef South	2.33	< 0.33	< 0.33	307	NC	NC	2	19
	Seringapatam Reef	10.67	< 0.33	< 0.33	335	NC	NC	4	20
	Vulcan Shoal	1.33	< 0.33	< 0.33	281	NC	NC	2	12
	Woodbine Bank	2.67	< 0.33	< 0.33	272	NC	NC	2	13
State Waters	Western Australia State Waters	21.67	< 0.33	< 0.33	183	NC	NC	6	45
WA Fisheries	Abalone	68.33	< 0.33	< 0.33	23	NC	NC	18	80
	Broome Prawn	68.33	< 0.33	< 0.33	23	NC	NC	18	80
	Kimberley Crab Fishery	100	100	< 0.33	1	2	NC	354	641
	Kimberley Prawn	36	< 0.33	< 0.33	67	NC	NC	9	68
	Mackerel Fishery	100	100	< 0.33	1	2	NC	354	641
	Northern Demersal Scalefish	100	100	< 0.33	1	2	NC	354	641
	South West Coast Salmon	100	100	< 0.33	1	2	NC	354	641
	Specimen Shell	68.33	< 0.33	< 0.33	23	NC	NC	18	80
	West Coast Deep Sea Crustacean	100	100	< 0.33	1	2	NC	354	641

NC: No contact to receptor predicted for specified threshold.

§ Probabilities and maximum concentrations calculated at depth of submerged feature.

1.4 Dissolved Aromatic Hydrocarbon

Table 1.4 Potential for exposure to dissolved aromatic hydrocarbons for individual sensitive receptors for Scenario 1. Annualised results.

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
Australian Marine Parks	Ashmore Reef MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Cartier Island MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Kimberley MP	0.33	< 0.33	< 0.33	< 0.33	495	NC	NC	NC	<1	9
Biologically Important Areas	Marine Turtle BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	3
	Seabirds BIA	0.67	0.33	< 0.33	< 0.33	266	840	NC	NC	<1	12
	Sharks BIA	5.67	3.67	0.33	< 0.33	149	152	1,111	NC	2	65
	Whales BIA	2	1	< 0.33	< 0.33	357	383	NC	NC	<1	24
Coastlines	Marnebulorgne Community N Point - Augereau Island (B)	0.33	< 0.33	< 0.33	< 0.33	768	NC	NC	NC	<1	10
	Scott Reef North	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	3
	Scott Reef South	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Exclusive Economic Zone	Australian Exclusive Economic Zone	84.33	66.33	3.33	< 0.33	3	4	91	NC	15	137
	Indonesian Exclusive Economic Zone	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	3
Fisheries	North-West Slope Trawl Fishery	84.33	66.33	3.33	< 0.33	3	4	91	NC	15	137
	Southern Bluefin Tuna Fishery	84.33	66.33	3.33	< 0.33	3	4	91	NC	15	137
	Western Skipjack Fishery	84.33	66.33	3.33	< 0.33	3	4	91	NC	15	137
	Western Tuna and Billfish Fishery	84.33	66.33	3.33	< 0.33	3	4	91	NC	15	137

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
IMCRA	Northwest Shelf	5.33	3.67	< 0.33	< 0.33	145	152	NC	NC	2	38
	Oceanic Shoals	1	0.33	< 0.33	< 0.33	520	521	NC	NC	<1	16
IBRA	Timor Sea Coral Islands	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Islands	Cartier Island	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Key Ecological Features	Ancient Coastline at 125m Depth Contour	5	2.67	< 0.33	< 0.33	153	153	NC	NC	2	35
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Continental Slope Demersal Fish Communities	15.33	10	1.67	< 0.33	41	112	322	NC	4	117
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	3
Nature Reserve	Scott Reef NR	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	3
Reefs, Shoals and Banks	Ashmore Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Echuca Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Eugene McDermott Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Goeree Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Heywood Shoal	0.33	< 0.33	< 0.33	< 0.33	522	NC	NC	NC	<1	10
	Johnson Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
	Sandy Islet	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Scott Reef North	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Scott Reef South	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	3
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Vulcan Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Woodbine Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
State Waters	Western Australia State Waters	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	4
WA Fisheries	Abalone	10.33	6	0.67	< 0.33	41	141	703	NC	3	132
	Broome Prawn	10.33	6	0.67	< 0.33	41	141	703	NC	3	132
	Kimberley Crab Fishery	84.33	66.33	3.33	< 0.33	3	4	91	NC	15	137
	Kimberley Prawn	4.67	2.67	0.33	< 0.33	188	352	1,890	NC	<1	58
	Mackerel Fishery	84.33	66.33	3.33	< 0.33	3	4	91	NC	15	137
	Northern Demersal Scalefish	84.33	66.33	3.33	< 0.33	3	4	91	NC	15	137
	South West Coast Salmon	84.33	66.33	3.33	< 0.33	3	4	91	NC	15	137
	Specimen Shell	10.33	6	0.67	< 0.33	41	141	703	NC	3	132
	West Coast Deep Sea Crustacean	84.33	66.33	3.33	< 0.33	3	4	91	NC	15	137

NC: No contact to receptor predicted for specified threshold.

§ Probabilities and maximum concentrations calculated at depth of submerged feature.

2 SCENARIO 2: SURFACE RELEASE OF 750 M^3 OF MARINE DIESEL DUE TO COLLISION DURING PRODUCT OFFLOADING

2.1 Floating Oil

Table 2.1 Potential for exposure to floating oil for individual sensitive receptors for Scenario 2. Annualised results.

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
Australian Marine Parks	Ashmore Reef MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Cartier Island MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Kimberley MP*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Biologically Important Areas	Marine Turtle BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Seabirds BIA	1	0.33	< 0.33	< 0.33	62	65	NC	NC
	Sharks BIA	1	0.33	< 0.33	< 0.33	64	64	NC	NC
	Whales BIA	1.67	< 0.33	< 0.33	< 0.33	103	NC	NC	NC
Coastlines	Marnebulorgne Community N Point - Augereau Island (B)	0.67	0.33	< 0.33	< 0.33	53	55	NC	NC
	Scott Reef North	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Scott Reef South	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Exclusive Economic Zone	Australian Exclusive Economic Zone*	100	100	100	100	1	1	1	1
	Indonesian Exclusive Economic Zone*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Fisheries	North-West Slope Trawl Fishery*	100	100	100	100	1	1	1	1
	Southern Bluefin Tuna Fishery	100	100	100	100	1	1	1	1
	Western Skipjack Fishery	100	100	100	100	1	1	1	1
	Western Tuna and Billfish Fishery	100	100	100	100	1	1	1	1
IMCRA	Northwest Shelf*	0.33	0.33	< 0.33	< 0.33	64	64	NC	NC
	Oceanic Shoals*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
IBRA	Timor Sea Coral Islands*	0.33	< 0.33	< 0.33	< 0.33	103	NC	NC	NC
Islands	Cartier Island	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Key Ecological Features	Ancient Coastline at 125m Depth Contour*	0.33	< 0.33	< 0.33	< 0.33	77	NC	NC	NC
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
	Continental Slope Demersal Fish Communities*	7	3.33	0.33	< 0.33	10	16	17	NC
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Nature Reserve	Scott Reef NR	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Reefs, Shoals and Banks	Ashmore Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Barracouta Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Echuca Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Eugene McDermott Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Goeree Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Heywood Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Jabiru Shoals*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Johnson Bank*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Sahul Bank*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Sandy Islet	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Scott Reef North*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Scott Reef South	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Seringapatam Reef*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Vulcan Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Woodbine Bank*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
State Waters	Western Australia State Waters*	0.33	0.33	< 0.33	< 0.33	64	65	NC	NC
WA Fisheries	Abalone*	2	1.33	< 0.33	< 0.33	44	54	NC	NC
	Broome Prawn*	2	1.33	< 0.33	< 0.33	44	54	NC	NC
	Kimberley Crab Fishery*	100	100	100	100	1	1	1	1
	Kimberley Prawn*	0.33	< 0.33	< 0.33	< 0.33	105	NC	NC	NC
	Mackerel Fishery*	100	100	100	100	1	1	1	1
	Northern Demersal Scalefish*	100	100	100	100	1	1	1	1
	Pilbara Crab Fishery*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	South West Coast Salmon*	100	100	100	100	1	1	1	1
	Specimen Shell*	2	1.33	< 0.33	< 0.33	44	54	NC	NC
	West Coast Deep Sea Crustacean*	100	100	100	100	1	1	1	1

NC: No contact to receptor predicted for specified threshold. NA: Not applicable

* Floating oil will not accumulate on submerged features and at open ocean locations.

2.2 Shoreline Oil Accumulation

Table 2.2 Potential for accumulation of oil onto shoreline receptors for Scenario 2. Annualised results. Calculations are for peak oil accumulation over time in any simulation for each receptor.

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
Australian Marine Parks	Ashmore Reef MP	0.33	< 0.33	< 0.33	419	NC	NC	<1	19	NC	<1	NC	NC	NC	NC	<1	4	NC	NC	NC	NC
	Cartier Island MP	0.33	< 0.33	< 0.33	401	NC	NC	<1	21	NC	2	NC	NC	NC	NC	<1	6	NC	NC	NC	NC
	Kimberley MP*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Biologically Important Areas	Marine Turtle BIA	0.67	< 0.33	< 0.33	351	NC	NC	<1	43	NC	2	NC	NC	NC	NC	<1	10	NC	NC	NC	NC
	Seabirds BIA	0.67	< 0.33	< 0.33	351	NC	NC	<1	43	NC	2	NC	NC	NC	NC	<1	10	NC	NC	NC	NC
	Sharks BIA	0.67	0.33	< 0.33	103	114	NC	3	792	<1	25	<1	25	NC	NC	<1	4	<1	4	NC	NC
	Whales BIA	0.67	< 0.33	< 0.33	351	NC	NC	<1	43	NC	<1	NC	NC	NC	NC	<1	4	NC	NC	NC	NC
Coastlines	Marnebulorgne Community N Point - Augereau Island (B)	0.67	0.33	< 0.33	103	114	NC	3	792	<1	25	<1	25	NC	NC	<1	4	<1	4	NC	NC
	Scott Reef North	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Scott Reef South	0.67	< 0.33	< 0.33	351	NC	NC	<1	43	NC	<1	NC	NC	NC	NC	<1	1	NC	NC	NC	NC
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Exclusive Economic Zone	Australian Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Indonesian Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fisheries	North-West Slope Trawl Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Southern Bluefin Tuna Fishery	0.67	0.33	< 0.33	103	114	NC	3	792	<1	25	<1	25	NC	NC	<1	10	<1	4	NC	NC
	Western Skipjack Fishery	0.67	0.33	< 0.33	103	114	NC	3	792	<1	25	<1	25	NC	NC	<1	10	<1	4	NC	NC
	Western Tuna and Billfish Fishery	0.67	0.33	< 0.33	103	114	NC	3	792	<1	25	<1	25	NC	NC	<1	10	<1	4	NC	NC
IMCRA	Northwest Shelf*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Oceanic Shoals*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
IBRA	Timor Sea Coral Islands*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Islands	Cartier Island	0.33	< 0.33	< 0.33	401	NC	NC	<1	21	NC	2	NC	NC	NC	NC	<1	6	NC	NC	NC	NC

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
Key Ecological Features	Ancient Coastline at 125m Depth Contour*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	0.33	< 0.33	< 0.33	401	NC	NC	<1	21	NC	2	NC	NC	NC	NC	<1	10	NC	NC	NC	NC
	Continental Slope Demersal Fish Communities*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	0.67	< 0.33	< 0.33	351	NC	NC	<1	43	NC	<1	NC	NC	NC	NC	<1	2	NC	NC	NC	NC
Nature Reserve	Scott Reef NR	0.67	< 0.33	< 0.33	351	NC	NC	<1	43	NC	<1	NC	NC	NC	NC	<1	2	NC	NC	NC	NC
Reefs, Shoals and Banks	Ashmore Reef	0.33	< 0.33	< 0.33	419	NC	NC	<1	19	NC	<1	NC	NC	NC	NC	<1	4	NC	NC	NC	NC
	Barracouta Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Echuca Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Eugene McDermott Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Goeree Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Heywood Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Jabiru Shoals*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Johnson Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sahul Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sandy Islet	0.67	< 0.33	< 0.33	351	NC	NC	<1	43	NC	<1	NC	NC	NC	NC	<1	2	NC	NC	NC	NC
	Scott Reef North*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Scott Reef South	0.67	< 0.33	< 0.33	351	NC	NC	<1	43	NC	<1	NC	NC	NC	NC	<1	2	NC	NC	NC	NC
	Seringapatam Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Vulcan Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Woodbine Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
State Waters	Western Australia State Waters*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Abalone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Broome Prawn*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kimberley Crab Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kimberley Prawn*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mackerel Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Northern Demersal Scalefish*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pilbara Crab Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
South West Coast Salmon*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Specimen Shell*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
West Coast Deep Sea Crustacean*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NC: No contact to receptor predicted for specified threshold. NA: Not applicable

* Floating oil will not accumulate on submerged features and at open ocean locations.

2.3 Entrained Oil

Table 2.3 Potential for exposure to entrained oil for individual sensitive receptors for Scenario 2. Annualised results.

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
Australian Marine Parks	Ashmore Reef MP	0.33	< 0.33	< 0.33	268	NC	NC	<1	27
	Cartier Island MP	1	< 0.33	< 0.33	339	NC	NC	<1	66
	Kimberley MP	2.67	0.33	< 0.33	178	201	NC	2	109
Biologically Important Areas	Marine Turtle BIA	3	0.67	< 0.33	114	250	NC	2	118
	Seabirds BIA	14.67	3.33	< 0.33	62	70	NC	10	597
	Sharks BIA	11.33	3.33	< 0.33	29	30	NC	14	793
	Whales BIA	14	4.67	< 0.33	77	78	NC	11	716
Coastlines	Marnebulorgne Community N Point - Augereau Island (B)	5.33	1	< 0.33	76	90	NC	3	172
	Scott Reef North	2.67	0.33	< 0.33	214	314	NC	2	128
	Scott Reef South	2	0.33	< 0.33	214	314	NC	<1	120
	Seringapatam Reef	4.33	< 0.33	< 0.33	195	NC	NC	2	86
Exclusive Economic Zone	Australian Exclusive Economic Zone	70.67	51	29.33	1	1	1	1,739	33,332
	Indonesian Exclusive Economic Zone	5	0.67	< 0.33	164	176	NC	3	182
Fisheries	North-West Slope Trawl Fishery	70.67	51	29.33	1	1	1	1,739	33,332
	Southern Bluefin Tuna Fishery	70.67	51	29.33	1	1	1	1,739	33,332
	Western Skipjack Fishery	70.67	51	29.33	1	1	1	1,739	33,332
	Western Tuna and Billfish Fishery	70.67	51	29.33	1	1	1	1,739	33,332
IMCRA	Northwest Shelf	11.33	3.33	< 0.33	30	31	NC	13	793
	Oceanic Shoals	2.33	0.33	< 0.33	119	122	NC	<1	256
IBRA	Timor Sea Coral Islands	3	0.67	< 0.33	113	250	NC	2	138
Islands	Cartier Island	0.67	< 0.33	< 0.33	353	NC	NC	<1	66
Key Ecological Features	Ancient Coastline at 125m Depth Contour	11	3	< 0.33	31	32	NC	12	768
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	1	0.33	< 0.33	245	267	NC	<1	103
	Continental Slope Demersal Fish Communities	32.67	19.33	3	9	12	13	109	4,688

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	5	0.33	< 0.33	191	302	NC	2	129
Nature Reserve	Scott Reef NR	2	0.33	< 0.33	214	314	NC	2	128
Reefs, Shoals and Banks	Ashmore Reef	0.33	< 0.33	< 0.33	366	NC	NC	<1	12
	Barracouta Shoal	0.33	< 0.33	< 0.33	296	NC	NC	<1	20
	Echuca Shoal	0.33	< 0.33	< 0.33	252	NC	NC	<1	16
	Eugene McDermott Shoal	0.33	< 0.33	< 0.33	349	NC	NC	<1	28
	Goeree Shoal	2	< 0.33	< 0.33	203	NC	NC	<1	69
	Heywood Shoal	1	< 0.33	< 0.33	348	NC	NC	<1	40
	Jabiru Shoals	0.33	< 0.33	< 0.33	492	NC	NC	<1	12
	Johnson Bank	0.33	< 0.33	< 0.33	253	NC	NC	<1	95
	Sahul Bank	0.33	< 0.33	< 0.33	503	NC	NC	<1	13
	Sandy Islet	1	< 0.33	< 0.33	257	NC	NC	<1	80
	Scott Reef North	2.67	< 0.33	< 0.33	215	NC	NC	<1	61
	Scott Reef South	2.33	0.33	< 0.33	207	302	NC	2	129
	Seringapatam Reef	4	< 0.33	< 0.33	195	NC	NC	2	86
	Vulcan Shoal	1.67	< 0.33	< 0.33	206	NC	NC	<1	82
	Woodbine Bank	0.67	< 0.33	< 0.33	261	NC	NC	<1	26
State Waters	Western Australia State Waters	4	0.67	< 0.33	89	232	NC	3	145
WA Fisheries	Abalone	16	6	0.33	20	20	21	23	1,642
	Broome Prawn	16	6	0.33	20	20	21	23	1,642
	Kimberley Crab Fishery	70.67	51	29.33	1	1	1	1,739	33,332
	Kimberley Prawn	4.67	1.67	< 0.33	58	60	NC	4	500
	Mackerel Fishery	70.67	51	29.33	1	1	1	1,739	33,332
	Northern Demersal Scalefish	70.67	51	29.33	1	1	1	1,739	33,332
	Pilbara Crab Fishery	0.33	< 0.33	< 0.33	439	NC	NC	<1	16
	South West Coast Salmon	70.67	51	29.33	1	1	1	1,739	33,332
	Specimen Shell	16	6	0.33	20	20	21	23	1,642
	West Coast Deep Sea Crustacean	70.67	51	29.33	1	1	1	1,739	33,332

NC: No contact to receptor predicted for specified threshold.

§ Probabilities and maximum concentrations calculated at depth of submerged feature.

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2.4 Dissolved Aromatic Hydrocarbon

Table 2.4 Potential for exposure to dissolved aromatic hydrocarbons for individual sensitive receptors for Scenario 2. Annualised results.

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
Australian Marine Parks	Ashmore Reef MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Cartier Island MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Kimberley MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Biologically Important Areas	Marine Turtle BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	4
	Seabirds BIA	0.67	0.33	< 0.33	< 0.33	72	75	NC	NC	<1	18
	Sharks BIA	0.33	0.33	< 0.33	< 0.33	50	60	NC	NC	<1	13
	Whales BIA	0.33	0.33	< 0.33	< 0.33	122	140	NC	NC	<1	13
Coastlines	Marnebulorgne Community N Point - Augereau Island (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Scott Reef North	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Scott Reef South	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Exclusive Economic Zone	Australian Exclusive Economic Zone	30.33	24.67	7	< 0.33	1	1	1	NC	14	315
	Indonesian Exclusive Economic Zone	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	6
Fisheries	North-West Slope Trawl Fishery	30.33	24.67	7	< 0.33	1	1	1	NC	14	315
	Southern Bluefin Tuna Fishery	30.33	24.67	7	< 0.33	1	1	1	NC	14	315
	Western Skipjack Fishery	30.33	24.67	7	< 0.33	1	1	1	NC	14	315
	Western Tuna and Billfish Fishery	30.33	24.67	7	< 0.33	1	1	1	NC	14	315

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
IMCRA	Northwest Shelf	0.33	< 0.33	< 0.33	< 0.33	49	NC	NC	NC	<1	8
	Oceanic Shoals	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
IBRA	Timor Sea Coral Islands	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Islands	Cartier Island	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Key Ecological Features	Ancient Coastline at 125m Depth Contour	0.33	< 0.33	< 0.33	< 0.33	52	NC	NC	NC	<1	7
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Continental Slope Demersal Fish Communities	3.33	1.33	< 0.33	< 0.33	15	15	NC	NC	<1	37
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Nature Reserve	Scott Reef NR	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Reefs, Shoals and Banks	Ashmore Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Barracouta Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Echuca Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Eugene McDermott Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Goeree Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Heywood Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Jabiru Shoals	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
	Johnson Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Sahul Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Sandy Islet	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Scott Reef North	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Scott Reef South	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Vulcan Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Woodbine Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
State Waters	Western Australia State Waters	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
WA Fisheries	Abalone	0.67	0.33	< 0.33	< 0.33	23	47	NC	NC	<1	13
	Broome Prawn	0.67	0.33	< 0.33	< 0.33	23	47	NC	NC	<1	13
	Kimberley Crab Fishery	30.33	24.67	7	< 0.33	1	1	1	NC	14	315
	Kimberley Prawn	0.33	< 0.33	< 0.33	< 0.33	74	NC	NC	NC	<1	10
	Mackerel Fishery	30.33	24.67	7	< 0.33	1	1	1	NC	14	315
	Northern Demersal Scalefish	30.33	24.67	7	< 0.33	1	1	1	NC	14	315
	Pilbara Crab Fishery	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	South West Coast Salmon	30.33	24.67	7	< 0.33	1	1	1	NC	14	315
	Specimen Shell	0.67	0.33	< 0.33	< 0.33	23	47	NC	NC	<1	13
	West Coast Deep Sea Crustacean	30.33	24.67	7	< 0.33	1	1	1	NC	14	315

NC: No contact to receptor predicted for specified threshold.

§ Probabilities and maximum concentrations calculated at depth of submerged feature.

3 SCENARIO 3: SURFACE RELEASE OF 1,000 M^3 OF HEAVY FUEL OIL DUE TO COLLISION DURING PRODUCT OFFLOADING

3.1 Floating Oil

Table 3.1 Potential for exposure to floating oil for individual sensitive receptors for Scenario 3. Annualised results.

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
Australian Marine Parks	Argo-Rowley Terrace MP*	6.67	1	< 0.33	< 0.33	253	269	NC	NC
	Ashmore Reef MP	3.67	2.33	0.67	0.33	173	176	181	183
	Cartier Island MP	1.33	0.33	< 0.33	< 0.33	184	315	NC	NC
	Joseph Bonaparte Gulf MP*	0.33	< 0.33	< 0.33	< 0.33	1,001	NC	NC	NC
	Kimberley MP*	3.67	1.67	0.33	< 0.33	105	105	106	NC
	Oceanic Shoals MP*	3	1	0.33	< 0.33	216	225	524	NC
Biologically Important Areas	Dolphins BIA	1.67	0.67	< 0.33	< 0.33	181	187	NC	NC
	Dugong BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Marine Turtle BIA	7.67	3.33	0.67	0.33	39	40	136	183
	River Sharks BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Seabirds BIA	9	4.67	0.67	0.33	59	59	60	183
	Sharks BIA	8.67	4.67	2.33	0.67	21	22	22	22
	Whales BIA	14.67	9.33	1.33	0.33	51	52	54	55
Coastlines	Cobourg Peninsula	0.67	< 0.33	< 0.33	< 0.33	909	NC	NC	NC
	Cox-Finniss	0.33	< 0.33	< 0.33	< 0.33	928	NC	NC	NC
	Indonesia	1	< 0.33	< 0.33	< 0.33	488	NC	NC	NC
	Joseph Bonaparte Gulf Northern Territory	0.33	< 0.33	< 0.33	< 0.33	918	NC	NC	NC
	Lombok	0.33	< 0.33	< 0.33	< 0.33	801	NC	NC	NC
	Minjilang	0.33	0.33	< 0.33	< 0.33	932	934	NC	NC
	Nusa Tenggara Barat	0.33	< 0.33	< 0.33	< 0.33	802	NC	NC	NC
	Nusa Tenggara Timur	1	< 0.33	< 0.33	< 0.33	486	NC	NC	NC
	Sumba Barat	1	< 0.33	< 0.33	< 0.33	723	NC	NC	NC
	Sumba Timur	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Sumbawa	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	West Arnhem	0.67	< 0.33	< 0.33	< 0.33	912	NC	NC	NC
	Augereau Island - Combe Hill Point (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Augereau Island - Combe Hill Point (B)	0.33	< 0.33	< 0.33	< 0.33	753	NC	NC	NC
	Augereau Island - Combe Hill Point (C)	0.33	< 0.33	< 0.33	< 0.33	754	NC	NC	NC
	Augereau Island - Combe Hill Point (D)	0.33	0.33	< 0.33	< 0.33	384	398	NC	NC

	Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
Augereau Island - Davidsons Point	1	0.67	0.33	< 0.33	175	179	185	NC
Battery Point - Cape Wellington	1	0.33	< 0.33	< 0.33	531	539	NC	NC
Battery Point - High Bluff (B)	1.33	< 0.33	< 0.33	< 0.33	557	NC	NC	NC
Battery Point - High Bluff (C)	0.33	< 0.33	< 0.33	< 0.33	574	NC	NC	NC
Cape Bougainville - Low Island Point (A)	0.33	< 0.33	< 0.33	< 0.33	689	NC	NC	NC
Cape Bougainville - Low Island Point (C)	1	< 0.33	< 0.33	< 0.33	457	NC	NC	NC
Cape Bougainville - Low Island Point (D)	1.33	0.67	< 0.33	< 0.33	442	686	NC	NC
Cape Talbot - Cape Londonderry (A)	0.33	< 0.33	< 0.33	< 0.33	772	NC	NC	NC
Cape Talbot - Cape Londonderry (B)	0.33	0.33	< 0.33	< 0.33	710	712	NC	NC
Cape Torrens - Anderdon Islands Point	0.33	< 0.33	< 0.33	< 0.33	778	NC	NC	NC
Cape Wellington - Cape Torrens (A)	0.33	0.33	< 0.33	< 0.33	766	786	NC	NC
Cape Wellington - Cape Torrens (B)	0.33	< 0.33	< 0.33	< 0.33	789	NC	NC	NC
Cape Wellington - Cape Torrens (C)	1.67	< 0.33	< 0.33	< 0.33	534	NC	NC	NC
Cape Wellington - Cape Torrens (D)	1.67	< 0.33	< 0.33	< 0.33	541	NC	NC	NC
Crystal Head - Cape Bougainville	0.67	0.67	< 0.33	< 0.33	693	695	NC	NC
Davidsons Point - Cape Bougainville (A)	1	0.67	< 0.33	< 0.33	273	295	NC	NC
Davidsons Point - Cape Bougainville (B)	1	0.33	< 0.33	< 0.33	284	347	NC	NC
Davidsons Point - Cape Bougainville (C)	1.67	0.67	< 0.33	< 0.33	251	254	NC	NC
Davidsons Point - Cape Bougainville (D)	2.33	0.33	< 0.33	< 0.33	242	243	NC	NC
Davidsons Point - Crystal Head (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Davidsons Point - Crystal Head (C)	0.33	< 0.33	< 0.33	< 0.33	666	NC	NC	NC
Davidsons Point - Crystal Head (D)	1	< 0.33	< 0.33	< 0.33	419	NC	NC	NC
High Bluff - Cape Wellington (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Low Island Point - Anjo (A)	0.33	0.33	< 0.33	< 0.33	703	705	NC	NC
Low Island Point - Anjo (B)	0.33	0.33	< 0.33	< 0.33	699	702	NC	NC
Low Island Point - Anjo (C)	1	0.33	< 0.33	< 0.33	372	694	NC	NC

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
	Marnebulorgne Community N Point - Augereau Island (A)	0.67	< 0.33	< 0.33	< 0.33	706	NC	NC	NC
	Marnebulorgne Community N Point - Augereau Island (B)	4	2	1	0.33	27	28	28	29
	Marnebulorgne Community N Point - Battery Point (A)	1	< 0.33	< 0.33	< 0.33	531	NC	NC	NC
	Scott Reef North	8	3.33	0.67	0.33	140	142	143	231
	Scott Reef South	7	3.33	0.67	0.33	153	178	235	235
	Seringapatam Reef	11.67	6	0.33	< 0.33	117	119	186	NC
	Swift Bay - Davidsons Point (A)	0.67	< 0.33	< 0.33	< 0.33	413	NC	NC	NC
	Swift Bay - Davidsons Point (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Exclusive Economic Zone	Australian Exclusive Economic Zone*	100	100	100	100	1	1	1	1
	Christmas Island Exclusive Economic Zone*	0.67	< 0.33	< 0.33	< 0.33	789	NC	NC	NC
	East Timorian Exclusive Economic Zone*	0.67	0.33	< 0.33	< 0.33	231	239	NC	NC
	Indonesian Exclusive Economic Zone*	9.67	3.33	0.33	0.33	106	107	110	294
Fisheries	North-West Slope Trawl Fishery*	100	100	100	100	1	1	1	1
	Northern Prawn Fishery	2.33	0.67	< 0.33	< 0.33	321	324	NC	NC
	Southern Bluefin Tuna Fishery	100	100	100	100	1	1	1	1
	Timor Reef Fishery (NT Managed)*	1.33	0.33	< 0.33	< 0.33	718	796	NC	NC
	Western Skipjack Fishery	100	100	100	100	1	1	1	1
	Western Tuna and Billfish Fishery	100	100	100	100	1	1	1	1
Indigenous Protected Area	Dambimangari	0.33	< 0.33	< 0.33	< 0.33	588	NC	NC	NC
	Uunguu	1	0.33	< 0.33	< 0.33	184	711	NC	NC
IMCRA	Anson Beagle*	0.67	< 0.33	< 0.33	< 0.33	768	NC	NC	NC
	Arafura*	0.67	0.33	< 0.33	< 0.33	881	884	NC	NC
	Bonaparte Gulf*	1.33	0.67	< 0.33	< 0.33	369	372	NC	NC
	Cambridge-Bonaparte*	0.33	< 0.33	< 0.33	< 0.33	989	NC	NC	NC
	Cobourg*	0.67	0.33	< 0.33	< 0.33	902	906	NC	NC
	Kimberley*	3	1.33	0.33	< 0.33	130	130	185	NC
	Northwest Shelf*	7.33	4.67	1.33	0.33	21	22	22	22
	Oceanic Shoals*	7.33	4.33	0.67	0.33	56	57	58	58
	Tiwi*	1	0.67	< 0.33	< 0.33	686	701	NC	NC
	Van Diemens Gulf*	0.33	< 0.33	< 0.33	< 0.33	964	NC	NC	NC

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
IBRA	Cobourg*	0.67	0.33	< 0.33	< 0.33	911	934	NC	NC
	Darwin Coastal*	0.33	< 0.33	< 0.33	< 0.33	928	NC	NC	NC
	Mitchell*	1.33	0.67	0.33	< 0.33	179	181	185	NC
	Murgenella*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Timor Sea Coral Islands*	3	1.67	0.67	0.33	34	39	136	136
	Tiwi*	0.67	0.67	< 0.33	< 0.33	701	715	NC	NC
Islands	Bathurst Island	0.67	0.67	< 0.33	< 0.33	699	715	NC	NC
	Cartier Island	0.67	< 0.33	< 0.33	< 0.33	315	NC	NC	NC
	Croker Island	0.33	0.33	< 0.33	< 0.33	933	936	NC	NC
	Melville Island	0.33	0.33	< 0.33	< 0.33	884	886	NC	NC
	Oxley Island	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Peron Island North	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Peron Islands	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Pulau Dana	0.33	< 0.33	< 0.33	< 0.33	494	NC	NC	NC
	Pulau Lahalura	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Pulau Mangudu	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Pulau Ndana	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Pulau Nuse	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Pulau Raijua	0.33	< 0.33	< 0.33	< 0.33	487	NC	NC	NC
	Pulau Rote	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Pulau Sawu	0.33	< 0.33	< 0.33	< 0.33	488	NC	NC	NC
Key Ecological Features	Ancient Coastline at 125m Depth Contour*	7.67	4.67	1	0.33	22	22	22	23
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	4.33	2.33	0.67	0.33	164	174	181	183
	Canyons linking the Argo Abyssal Plain with the Scott Plateau*	5.67	0.67	< 0.33	< 0.33	395	540	NC	NC
	Carbonate Bank and Terrace System of the Sahul Shelf*	3.67	1.33	0.33	< 0.33	146	151	524	NC
	Carbonate Bank and Terrace System of the Van Diemen Rise*	1.33	0.67	< 0.33	< 0.33	551	674	NC	NC
	Continental Slope Demersal Fish Communities*	22.33	16.67	9.33	4.33	9	9	10	11
	Pinnacles of the Bonaparte Basin*	1.67	0.33	< 0.33	< 0.33	383	421	NC	NC
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	11.67	6	0.67	0.33	108	109	140	231
	Shelf Break and Slope of the Arafura Shelf*	0.33	< 0.33	< 0.33	< 0.33	978	NC	NC	NC
Marine Parks	Lalang-garram / Camden Sound MP	1	< 0.33	< 0.33	< 0.33	506	NC	NC	NC
	North Kimberley MP	2	0.67	0.33	< 0.33	169	171	185	NC

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
	North Lalang-garram MP	1.33	0.33	< 0.33	< 0.33	530	540	NC	NC
National Park	Garig Gunak Barlu NP	0.67	0.33	< 0.33	< 0.33	904	920	NC	NC
National Park	Prince Regent NP*	0.33	0.33	< 0.33	< 0.33	778	786	NC	NC
Nature Reserve	Scott Reef NR	6	2.67	0.67	< 0.33	154	178	239	NC
Reefs, Shoals and Banks	Cobourg Peninsula*	0.67	< 0.33	< 0.33	< 0.33	904	NC	NC	NC
Reefs, Shoals and Banks	Ashmore Reef	3	1.67	0.67	0.33	176	180	183	184
Reefs, Shoals and Banks	Baldwin Bank*	2	0.33	< 0.33	< 0.33	315	343	NC	NC
Reefs, Shoals and Banks	Barracouta Shoal*	1.67	0.33	< 0.33	< 0.33	270	308	NC	NC
Reefs, Shoals and Banks	Bassett-Smith Shoal*	1.67	< 0.33	< 0.33	< 0.33	393	NC	NC	NC
Reefs, Shoals and Banks	Beagle and Dingo Reefs*	0.67	< 0.33	< 0.33	< 0.33	705	NC	NC	NC
Reefs, Shoals and Banks	Big Bank Shoals*	0.33	< 0.33	< 0.33	< 0.33	916	NC	NC	NC
Reefs, Shoals and Banks	Branch Banks*	0.67	0.67	< 0.33	< 0.33	296	297	NC	NC
Reefs, Shoals and Banks	Calder Shoal*	0.33	< 0.33	< 0.33	< 0.33	879	NC	NC	NC
Reefs, Shoals and Banks	Cootamundra Shoal*	0.33	< 0.33	< 0.33	< 0.33	889	NC	NC	NC
Reefs, Shoals and Banks	Deep Shoal 1*	1.67	0.33	< 0.33	< 0.33	310	318	NC	NC
Reefs, Shoals and Banks	Deep Shoal 2*	1.33	< 0.33	< 0.33	< 0.33	415	NC	NC	NC
Reefs, Shoals and Banks	East Holothuria Reef*	0.67	< 0.33	< 0.33	< 0.33	296	NC	NC	NC
Reefs, Shoals and Banks	Echuca Shoal*	6.67	4	0.67	< 0.33	57	57	58	NC
Reefs, Shoals and Banks	Elphinstone Reef*	0.33	< 0.33	< 0.33	< 0.33	942	NC	NC	NC
Reefs, Shoals and Banks	Eugene McDermott Shoal*	4.33	0.67	< 0.33	< 0.33	116	117	NC	NC
Reefs, Shoals and Banks	Favell Bank*	1.67	0.67	< 0.33	< 0.33	314	328	NC	NC
Reefs, Shoals and Banks	Fitzpatrick Shoal*	0.33	< 0.33	< 0.33	< 0.33	976	NC	NC	NC
Reefs, Shoals and Banks	Flat Top Bank*	1	0.33	< 0.33	< 0.33	635	789	NC	NC
Reefs, Shoals and Banks	Gale Bank*	2.33	< 0.33	< 0.33	< 0.33	257	NC	NC	NC
Reefs, Shoals and Banks	Goeree Shoal*	2.33	1	< 0.33	< 0.33	267	276	NC	NC
Reefs, Shoals and Banks	Goodrich Bank*	0.67	< 0.33	< 0.33	< 0.33	841	NC	NC	NC
Reefs, Shoals and Banks	Heritage Reef*	0.67	< 0.33	< 0.33	< 0.33	385	NC	NC	NC
Reefs, Shoals and Banks	Heywood Shoal*	5.33	1.67	0.67	0.33	59	60	60	91
Reefs, Shoals and Banks	Hibernia Reef*	1.67	< 0.33	< 0.33	< 0.33	249	NC	NC	NC
Reefs, Shoals and Banks	Holothuria Banks*	1.67	0.67	< 0.33	< 0.33	285	295	NC	NC
Reefs, Shoals and Banks	Ingram Reef*	0.33	< 0.33	< 0.33	< 0.33	548	NC	NC	NC
Reefs, Shoals and Banks	Jabiru Shoals*	0.67	0.33	< 0.33	< 0.33	756	800	NC	NC
Reefs, Shoals and Banks	Jamieson Reef*	1.33	< 0.33	< 0.33	< 0.33	287	NC	NC	NC
Reefs, Shoals and Banks	Johnson Bank*	3.33	1.67	0.67	< 0.33	203	206	258	NC
Reefs, Shoals and Banks	Karmt Shoal*	0.33	< 0.33	< 0.33	< 0.33	894	NC	NC	NC
Reefs, Shoals and Banks	Long Reef*	1.33	0.67	< 0.33	< 0.33	253	266	NC	NC
Reefs, Shoals and Banks	Mangola Shoal*	0.33	< 0.33	< 0.33	< 0.33	792	NC	NC	NC
Reefs, Shoals and Banks	Marie Shoal*	1	0.33	< 0.33	< 0.33	831	832	NC	NC
Reefs, Shoals and Banks	Mermaid Shoal*	0.67	0.33	< 0.33	< 0.33	864	868	NC	NC

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
	Moss Shoal*	0.67	< 0.33	< 0.33	< 0.33	870	NC	NC	NC
	Newby Shoal*	0.67	0.33	< 0.33	< 0.33	635	797	NC	NC
	Oliver Rock*	1.33	< 0.33	< 0.33	< 0.33	591	NC	NC	NC
	Orontes Reef*	0.67	< 0.33	< 0.33	< 0.33	906	NC	NC	NC
	Osborn Reefs*	1	< 0.33	< 0.33	< 0.33	530	NC	NC	NC
	Otway Bank*	0.67	0.67	< 0.33	< 0.33	283	284	NC	NC
	Parry Shoal*	0.67	< 0.33	< 0.33	< 0.33	839	NC	NC	NC
	Pee Shoal*	0.67	< 0.33	< 0.33	< 0.33	768	NC	NC	NC
	Penguin Shoal*	1	0.33	< 0.33	< 0.33	495	845	NC	NC
	Robroy Reefs*	1.67	0.33	< 0.33	< 0.33	175	176	NC	NC
	Rothery Reef*	0.67	< 0.33	< 0.33	< 0.33	258	NC	NC	NC
	Sahul Bank*	2	1	0.33	< 0.33	260	270	291	NC
	Sandy Islet	7	2	0.33	< 0.33	171	238	238	NC
	Scott Reef North*	8.67	3.67	0.33	< 0.33	121	137	141	NC
	Scott Reef South	7	3.33	0.67	0.33	149	152	229	231
	Seringapatam Reef*	11.67	6	0.33	< 0.33	118	120	186	NC
	Shepparton Shoal*	0.33	< 0.33	< 0.33	< 0.33	751	NC	NC	NC
	Tait Bank*	0.33	< 0.33	< 0.33	< 0.33	469	NC	NC	NC
	Tassie Shoal*	0.33	< 0.33	< 0.33	< 0.33	986	NC	NC	NC
	The Boxers*	0.67	< 0.33	< 0.33	< 0.33	761	NC	NC	NC
	The Boxers Area*	1.33	0.67	< 0.33	< 0.33	603	677	NC	NC
	Van Cloon Shoal*	1	0.67	< 0.33	< 0.33	435	461	NC	NC
	Vee Shoal*	0.67	< 0.33	< 0.33	< 0.33	607	NC	NC	NC
	Vulcan Shoal*	2	1	0.33	< 0.33	274	287	545	NC
	West Holothuria Reef*	1	0.33	< 0.33	< 0.33	373	498	NC	NC
	Wildcat Reefs*	1	< 0.33	< 0.33	< 0.33	522	NC	NC	NC
	Woodbine Bank*	1.33	< 0.33	< 0.33	< 0.33	209	NC	NC	NC
State Waters	Northern Territory Sate Waters*	1	0.67	< 0.33	< 0.33	690	701	NC	NC
	Western Australia State Waters*	7	3.33	1	0.33	30	30	32	33
WA Fisheries	Abalone*	9.67	5.33	2.67	0.67	17	17	18	18
	Broome Prawn*	9.67	5.33	2.67	0.67	17	17	18	18
	Kimberley Crab Fishery*	100	100	100	100	1	1	1	1
	Kimberley Gillnet and Barramundi*	1.33	0.67	< 0.33	< 0.33	417	691	NC	NC
	Kimberley Prawn*	7.67	4.67	2	0.33	31	33	39	43
	Mackerel Fishery*	100	100	100	100	1	1	1	1
	Northern Demersal Scalefish*	100	100	100	100	1	1	1	1
	Pilbara Crab Fishery*	6.67	1	< 0.33	< 0.33	239	242	NC	NC
	South West Coast Salmon*	100	100	100	100	1	1	1	1
	Specimen Shell*	9.67	5.33	2.67	0.67	17	17	18	18
	West Coast Deep Sea Crustacean*	100	100	100	100	1	1	1	1

NC: No contact to receptor predicted for specified threshold. NA: Not applicable

* Floating oil will not accumulate on submerged features and at open ocean locations.

3.2 Shoreline Oil Accumulation

Table 3.2 Potential for accumulation of oil onto shoreline receptors for Scenario 3. Annualised results. Calculations are for peak oil accumulation over time in any simulation for each receptor.

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
Australian Marine Parks	Argo-Rowley Terrace MP*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ashmore Reef MP	5	3.67	3	175	176	184	161	10,127	8	804	8	800	5	742	4	62	3	49	<1	20
	Cartier Island MP	1.67	1	0.33	187	312	371	23	6,061	3	243	3	243	3	223	<1	11	<1	11	<1	6
	Joseph Bonaparte Gulf MP*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kimberley MP*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Oceanic Shoals MP*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Biologically Important Areas	Dolphins BIA	2.33	1.67	1.33	180	181	186	85	10,170	48	786	46	766	36	611	9	176	5	66	2	26
	Dugong BIA	4	3.67	2	176	177	185	57	6,029	<1	199	<1	199	NC	199	<1	4	<1	4	<1	4
	Marine Turtle BIA	10.67	7.67	4.33	171	174	184	207	10,166	55	804	53	800	42	742	8	101	5	61	2	29
	River Sharks BIA	1	< 0.33	< 0.33	560	NC	NC	<1	24	<1	<1	NC	NC	NC	NC	<1	2	NC	NC	NC	NC
	Seabirds BIA	10.67	7.67	4.33	171	174	184	207	10,170	74	804	71	800	54	742	14	241	7	79	2	26
	Sharks BIA	5.33	4.33	3.33	39	39	41	195	10,163	19	407	19	407	18	407	<1	5	<1	5	<1	4
	Whales BIA	10.67	7.67	4.33	171	174	184	207	10,166	24	804	23	800	15	742	6	80	3	49	2	20
Coastlines	Cobourg Peninsula	0.67	0.67	0.33	901	905	945	16	4,519	9	667	8	660	7	565	2	65	<1	48	<1	24
	Cox-Finniss	0.33	0.33	< 0.33	916	928	NC	4	958	2	127	2	118	NC	NC	<1	50	<1	27	NC	NC
	Indonesia	2	1.33	0.33	487	490	737	14	2,872	<1	512	NC	485	NC	171	7	182	3	109	<1	12
	Joseph Bonaparte Gulf Northern Territory	0.33	0.33	< 0.33	916	928	NC	4	958	2	127	2	118	NC	NC	<1	50	<1	27	NC	NC
	Lombok	0.33	0.33	0.33	802	803	882	4	1,030	NC	110	NC	93	NC	11	<1	66	<1	27	<1	1
	Minjilang	0.33	0.33	0.33	934	936	941	28	8,096	6	536	6	532	5	494	<1	36	<1	25	<1	15
	Nusa Tenggara Barat	0.33	0.33	0.33	762	788	882	4	1,030	NC	121	NC	102	NC	11	<1	75	<1	30	<1	1
	Nusa Tenggara Timur	2	1.33	0.33	487	490	737	14	2,872	<1	511	NC	485	NC	171	6	168	3	109	<1	12
	Sumba Barat	2	1.33	0.33	708	720	737	14	2,872	NC	450	NC	441	NC	171	4	109	2	84	<1	12
	Sumba Timur	1	0.67	< 0.33	678	700	NC	4	440	NC	64	NC	48	NC	NC	2	66	<1	26	NC	NC
	Sumbawa	0.33	0.33	< 0.33	762	788	NC	<1	215	NC	5	NC	3	NC	NC	<1	14	<1	1	NC	NC
	West Arnhem	0.67	0.67	0.33	901	905	930	16	4,519	9	674	9	667	7	565	2	68	<1	50	<1	24
	Augereau Island - Combe Hill Point (A)	0.67	< 0.33	< 0.33	209	NC	NC	<1	83	<1	3	NC	NC	NC	NC	<1	7	NC	NC	NC	NC
	Augereau Island - Combe Hill Point (B)	0.67	< 0.33	< 0.33	221	NC	NC	<1	48	<1	<1	NC	NC	NC	NC	<1	5	NC	NC	NC	NC
	Augereau Island - Combe Hill Point (C)	0.67	0.33	0.33	661	757	773	5	1,230	<1	47	<1	45	<1	13	<1	16	<1	8	<1	1

	Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
Augereau Island - Combe Hill Point (D)	1	0.33	0.33	227	386	389	29	8,460	2	198	2	198	2	198	<1	5	<1	4	<1	4
Augereau Island - Davidsons Point	1.67	1.67	1	179	180	181	85	10,170	19	720	18	720	17	678	2	29	<1	29	<1	16
Battery Point - Cape Wellington	1.33	1	1	536	541	546	28	5,207	3	133	3	132	2	107	<1	8	<1	7	<1	3
Battery Point - High Bluff (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Battery Point - High Bluff (C)	1.33	1	< 0.33	558	587	NC	4	732	<1	19	<1	15	NC	NC	<1	15	<1	5	NC	NC
Cape Bougainville - Low Island Point (A)	0.67	0.33	0.33	684	688	691	8	2,375	2	133	2	128	<1	91	<1	22	<1	12	<1	6
Cape Bougainville - Low Island Point (C)	0.67	0.33	< 0.33	685	686	NC	3	701	<1	14	<1	14	NC	NC	<1	5	<1	3	NC	NC
Cape Bougainville - Low Island Point (D)	2	1.67	1	294	442	453	37	7,010	10	579	10	577	8	524	2	37	<1	30	<1	17
Cape Talbot - Cape Londonderry (A)	0.67	0.33	< 0.33	724	724	NC	2	500	<1	8	<1	6	NC	NC	<1	13	<1	2	NC	NC
Cape Talbot - Cape Londonderry (B)	0.67	0.67	0.33	714	720	722	9	2,608	<1	79	<1	78	<1	59	<1	15	<1	7	<1	3
Cape Torrens - Anderdon Islands Point	0.33	0.33	0.33	778	779	792	6	1,659	2	124	2	115	<1	43	<1	33	<1	18	<1	3
Cape Wellington - Cape Torrens (A)	1	0.67	0.33	600	767	771	12	3,344	3	287	3	278	2	182	<1	54	<1	28	<1	9
Cape Wellington - Cape Torrens (B)	1.33	0.67	< 0.33	579	794	NC	2	334	<1	25	<1	16	NC	NC	<1	25	<1	7	NC	NC
Cape Wellington - Cape Torrens (C)	1.67	1.67	0.33	534	535	550	14	2,682	5	232	5	225	2	148	2	36	<1	27	<1	8
Cape Wellington - Cape Torrens (D)	1.67	1.33	< 0.33	587	622	NC	7	793	<1	8	<1	8	NC	NC	<1	1	<1	1	NC	NC
Crystal Head - Cape Bougainville	1.33	0.67	0.33	480	704	706	14	3,786	4	360	4	351	3	293	<1	45	<1	29	<1	12
Davidsons Point - Cape Bougainville (A)	1.33	0.33	0.33	295	716	743	4	1,005	<1	26	<1	26	<1	11	<1	4	<1	4	<1	1
Davidsons Point - Cape Bougainville (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Davidsons Point - Cape Bougainville (C)	2.33	1.67	1.33	254	254	255	74	10,160	7	275	6	275	6	275	<1	4	<1	4	<1	4
Davidsons Point - Cape Bougainville (D)	2	1.67	1.33	290	434	646	43	4,487	4	90	4	90	3	90	<1	4	<1	4	<1	4
Davidsons Point - Crystal Head (A)	0.67	< 0.33	< 0.33	719	NC	NC	<1	30	<1	<1	NC	NC	NC	NC	<1	3	NC	NC	NC	NC
Davidsons Point - Crystal Head (C)	1	1	< 0.33	439	441	NC	4	493	<1	7	<1	5	NC	NC	<1	10	<1	3	NC	NC
Davidsons Point - Crystal Head (D)	1.67	1.33	0.67	250	420	428	20	5,680	4	285	4	284	3	227	<1	24	<1	20	<1	10

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
	High Bluff - Cape Wellington (B)	0.33	0.33	< 0.33	779	795	NC	<1	121	<1	3	<1	2	NC	NC	<1	9	<1	1	NC	NC
	Low Island Point - Anjo (A)	0.67	0.67	0.33	701	706	709	5	1,364	<1	34	<1	32	<1	14	<1	11	<1	4	<1	1
	Low Island Point - Anjo (B)	0.67	0.67	< 0.33	693	700	NC	2	509	<1	22	<1	17	NC	NC	<1	17	<1	6	NC	NC
	Low Island Point - Anjo (C)	1.33	1	0.33	440	470	474	13	3,224	<1	33	<1	33	<1	33	<1	1	<1	1	<1	1
	Marnebulorgne Community N Point - Augereau Island (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Marnebulorgne Community N Point - Augereau Island (B)	5.33	4.33	3.33	39	39	41	195	10,163	19	407	19	407	18	407	<1	4	<1	4	<1	4
	Marnebulorgne Community N Point - Battery Point (A)	0.67	0.33	< 0.33	548	988	NC	<1	103	<1	2	<1	2	NC	NC	<1	4	<1	1	NC	NC
	Scott Reef North	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Scott Reef South	10.67	7	4.33	176	180	254	207	10,165	<1	102	<1	102	<1	102	<1	1	<1	1	<1	1
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Swift Bay - Davidsons Point (A)	1.33	0.67	0.67	255	427	431	11	1,494	<1	31	<1	28	<1	15	<1	14	<1	7	<1	1
	Swift Bay - Davidsons Point (B)	0.33	0.33	< 0.33	674	691	NC	<1	116	<1	2	<1	2	NC	NC	<1	2	<1	1	NC	NC
Exclusive Economic Zone	Australian Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Christmas Island Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	East Timorian Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Indonesian Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fisheries	North-West Slope Trawl Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Northern Prawn Fishery	1	0.67	0.67	693	701	711	33	8,096	39	800	38	794	31	692	5	101	3	61	2	29
	Southern Bluefin Tuna Fishery	10.67	7.67	4.33	39	39	41	207	10,170	139	825	135	822	110	779	20	257	11	100	4	29
	Timor Reef Fishery (NT Managed)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Western Skipjack Fishery	10.67	7.67	4.33	39	39	41	207	10,170	139	825	135	822	110	779	20	257	11	100	4	29
	Western Tuna and Billfish Fishery	10.67	7.67	4.33	39	39	41	207	10,170	139	825	135	822	110	779	20	257	11	100	4	29

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
Indigenous Protected Area	Dambimangari	1.33	1	< 0.33	548	587	NC	4	732	<1	19	<1	15	NC	NC	<1	23	<1	7	NC	NC
	Uunguu	2	1.67	1.33	180	181	186	73	10,170	26	512	25	509	20	432	5	116	3	40	<1	17
IMCRA	Anson Beagle*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Arafura*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bonaparte Gulf*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Cambridge-Bonaparte*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Cobourg*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kimberley*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Northwest Shelf*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Oceanic Shoals*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Tiwi*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Van Diemens Gulf*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
IBRA	Cobourg*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Darwin Coastal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mitchell*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Murgenella*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Timor Sea Coral Islands*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Tiwi*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Islands	Bathurst Island	1	0.67	0.67	693	701	711	33	5,201	17	800	17	794	15	692	2	88	2	56	<1	29
	Cartier Island	1.67	1	0.33	187	312	371	23	6,061	3	243	3	243	3	223	<1	11	<1	11	<1	6
	Croker Island	0.33	0.33	0.33	934	936	941	28	8,096	6	536	6	532	5	494	<1	36	<1	25	<1	15
	Melville Island	0.67	0.67	0.33	876	887	889	21	6,182	5	444	5	439	5	399	<1	29	<1	19	<1	12
	Oxley Island	0.33	0.33	< 0.33	970	992	NC	<1	175	<1	6	<1	3	NC	NC	<1	8	<1	2	NC	NC
	Peron Island North	0.33	0.33	< 0.33	916	937	NC	<1	132	<1	3	<1	2	NC	NC	<1	5	<1	1	NC	NC
	Peron Islands	0.33	0.33	< 0.33	916	937	NC	<1	132	<1	3	<1	2	NC	NC	<1	5	<1	1	NC	NC
	Pulau Dana	1.33	0.67	< 0.33	494	495	NC	4	528	NC	6	NC	6	NC	NC	<1	1	<1	1	NC	NC
	Pulau Lahalura	0.33	< 0.33	< 0.33	915	NC	NC	<1	19	NC	<1	NC	NC	NC	NC	<1	2	NC	NC	NC	NC
	Pulau Mangudu	0.33	< 0.33	< 0.33	914	NC	NC	<1	23	NC	<1	NC	NC	NC	NC	<1	1	NC	NC	NC	NC
	Pulau Ndana	0.33	< 0.33	< 0.33	959	NC	NC	<1	63	<1	2	NC	NC	NC	NC	<1	3	NC	NC	NC	NC
	Pulau Nuse	0.33	< 0.33	< 0.33	981	NC	NC	<1	11	<1	<1	NC	NC	NC	NC	<1	1	NC	NC	NC	NC
	Pulau Raijua	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Pulau Rote	0.33	< 0.33	< 0.33	946	NC	NC	<1	13	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Pulau Sawu	0.67	0.33	< 0.33	487	490	NC	<1	250	<1	31	NC	17	NC	NC	<1	41	<1	12	NC	NC

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
Key Ecological Features	Ancient Coastline at 125m Depth Contour*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	5	3.67	3	175	176	184	161	10,127	11	804	10	800	7	742	4	68	3	54	<1	20
	Canyons linking the Argo Abyssal Plain with the Scott Plateau*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Carbonate Bank and Terrace System of the Sahul Shelf*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Carbonate Bank and Terrace System of the Van Diemen Rise*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Continental Slope Demersal Fish Communities*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pinnacles of the Bonaparte Basin*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	10.67	7.67	4.33	171	174	254	207	10,166	<1	204	<1	204	<1	204	<1	2	<1	2	<1	2
	Shelf Break and Slope of the Arafura Shelf*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Marine Parks	Lalang-garram / Camden Sound MP	1.33	1	< 0.33	548	587	NC	4	732	<1	24	<1	17	NC	NC	<1	26	<1	8	NC	NC
	North Kimberley MP	2.33	1.67	1.33	179	180	181	85	10,170	63	825	61	822	48	779	11	242	6	92	2	26
	North Lalang-garram MP	1.33	1	1	536	541	546	28	5,207	3	133	3	132	2	107	<1	12	<1	10	<1	3
National Park	Garig Gunak Barlu NP	0.67	0.67	0.33	901	905	930	16	4,519	9	674	9	667	7	565	2	68	<1	50	<1	24
	Prince Regent NP*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nature Reserve	Scott Reef NR	10.67	7.67	4.33	171	174	254	207	10,166	<1	204	<1	204	<1	204	<1	2	<1	2	<1	2
Ramsar	Cobourg Peninsula*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reefs, Shoals and Banks	Ashmore Reef	5	3.67	3	175	176	184	161	10,127	8	804	8	800	5	742	4	62	3	49	<1	20
	Baldwin Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Barracouta Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bassett-Smith Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Beagle and Dingo Reefs*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
Big Bank Shoals*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Branch Banks*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calder Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cootamundra Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Deep Shoal 1*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Deep Shoal 2*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
East Holothuria Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Echuca Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Elphinstone Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eugene McDermott Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Favell Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fitzpatrick Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Flat Top Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gale Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Goeree Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Goodrich Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heritage Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heywood Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hibernia Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Holothuria Banks*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ingram Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Jabiru Shoals*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Jamieson Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Johnson Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Karmt Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Long Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mangola Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Marie Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mermaid Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Moss Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Newby Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Oliver Rock*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Orontes Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Osborn Reefs*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Otway Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Parry Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pee Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Penguin Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Robroy Reefs*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
	Rothery Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sahul Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sandy Islet	10.67	7.67	4.33	171	174	254	207	10,166	<1	204	<1	204	<1	204	<1	2	<1	2	<1	2
	Scott Reef North*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Scott Reef South	10.67	7.67	4.33	171	174	254	207	10,166	<1	204	<1	204	<1	204	<1	2	<1	2	<1	2
	Seringapatam Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Shepparton Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Tait Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Tassie Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	The Boxers*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	The Boxers Area*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Van Cloon Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Vee Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Vulcan Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	West Holothuria Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Wildcat Reefs*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Woodbine Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
State Waters	Northern Territory Sate Waters*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
State Waters	Western Australia State Waters*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Abalone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Broome Prawn*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Kimberley Crab Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Kimberley Gillnet and Barramundi*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Kimberley Prawn*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Mackerel Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Northern Demersal Scalefish*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Pilbara Crab Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	South West Coast Salmon*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Specimen Shell*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	West Coast Deep Sea Crustacean*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NC: No contact to receptor predicted for specified threshold. NA: Not applicable

* Floating oil will not accumulate on submerged features and at open ocean locations.

3.3 Entrained Oil

Table 3.3 Potential for exposure to entrained oil for individual sensitive receptors for Scenario 3. Annualised results.

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
Australian Marine Parks	Argo-Rowley Terrace MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Ashmore Reef MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Cartier Island MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Joseph Bonaparte Gulf MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Kimberley MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	3
	Oceanic Shoals MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Biologically Important Areas	Dolphins BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Dugong BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Marine Turtle BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	River Sharks BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Seabirds BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	2
	Sharks BIA	0.67	0.33	< 0.33	30	32	NC	<1	151
	Whales BIA	0.67	< 0.33	< 0.33	91	NC	NC	<1	21
Coastlines	Cobourg Peninsula	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cox-Finniss	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Indonesia	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Joseph Bonaparte Gulf Northern Territory	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Lombok	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Minjilang	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Nusa Tenggara Barat	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Nusa Tenggara Timur	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Sumba Barat	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Sumba Timur	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Sumbawa	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	West Arnhem	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Augereau Island - Combe Hill Point (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Augereau Island - Combe Hill Point (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Augereau Island - Combe Hill Point (C)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Augereau Island - Combe Hill Point (D)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Augereau Island - Davidsons Point	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
	Battery Point - Cape Wellington	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Battery Point - High Bluff (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Battery Point - High Bluff (C)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cape Bougainville - Low Island Point (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cape Bougainville - Low Island Point (C)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cape Bougainville - Low Island Point (D)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cape Talbot - Cape Londonderry (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cape Talbot - Cape Londonderry (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cape Torrens - Anderdon Islands Point	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cape Wellington - Cape Torrens (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cape Wellington - Cape Torrens (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cape Wellington - Cape Torrens (C)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cape Wellington - Cape Torrens (D)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Crystal Head - Cape Bougainville	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Davidsons Point - Cape Bougainville (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Davidsons Point - Cape Bougainville (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Davidsons Point - Cape Bougainville (C)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Davidsons Point - Cape Bougainville (D)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Davidsons Point - Crystal Head (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Davidsons Point - Crystal Head (C)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Davidsons Point - Crystal Head (D)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	High Bluff - Cape Wellington (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Low Island Point - Anjo (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Low Island Point - Anjo (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Low Island Point - Anjo (C)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
	Marnebulorgne Community N Point - Augereau Island (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Marnebulorgne Community N Point - Augereau Island (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Marnebulorgne Community N Point - Battery Point (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Scott Reef North	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Scott Reef South	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Swift Bay - Davidsons Point (A)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Swift Bay - Davidsons Point (B)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Exclusive Economic Zone	Australian Exclusive Economic Zone	40.67	19	5.33	1	1	1	191	8,825
	Christmas Island Exclusive Economic Zone	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	East Timorian Exclusive Economic Zone	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Indonesian Exclusive Economic Zone	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
Fisheries	North-West Slope Trawl Fishery	40.67	19	5.33	1	1	1	191	8,825
	Northern Prawn Fishery	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Southern Bluefin Tuna Fishery	40.67	19	5.33	1	1	1	191	8,825
	Timor Reef Fishery (NT Managed)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Western Skipjack Fishery	40.67	19	5.33	1	1	1	191	8,825
	Western Tuna and Billfish Fishery	40.67	19	5.33	1	1	1	191	8,825
Indigenous Protected Area	Dambimangari	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Uunguu	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
IMCRA	Anson Beagle	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Arafura	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Bonaparte Gulf	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cambridge-Bonaparte	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cobourg	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Kimberley	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
	Northwest Shelf	0.67	0.33	< 0.33	30	32	NC	<1	151
	Oceanic Shoals	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	4
	Tiwi	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Van Diemens Gulf	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
IBRA	Cobourg	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Darwin Coastal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Mitchell	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Murgenella	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Timor Sea Coral Islands	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Tiwi	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Islands	Bathurst Island	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Cartier Island	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Croker Island	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Melville Island	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Oxley Island	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Peron Island North	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Peron Islands	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Pulau Dana	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Pulau Lahalura	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Pulau Mangudu	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Pulau Ndana	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Pulau Nuse	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Pulau Raijua	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Pulau Rote	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Pulau Sawu	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Key Ecological Features	Ancient Coastline at 125m Depth Contour	0.67	0.33	< 0.33	31	33	NC	<1	151
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Canyons linking the Argo Abyssal Plain with the Scott Plateau	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Carbonate Bank and Terrace System of the Sahul Shelf	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Carbonate Bank and Terrace System of the Van Diemen Rise	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
	Continental Slope Demersal Fish Communities	1.67	0.67	< 0.33	14	19	NC	2	354
	Pinnacles of the Bonaparte Basin	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Shelf Break and Slope of the Arafura Shelf	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Marine Parks	Lalang-garram / Camden Sound MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Marine Parks	North Kimberley MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Marine Parks	North Lalang-garram MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
National Park	Garig Gunak Barlu NP	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
National Park	Prince Regent NP	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Nature Reserve	Scott Reef NR	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
Ramsar	Cobourg Peninsula	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Ashmore Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
Reefs, Shoals and Banks	Baldwin Bank	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Barracouta Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
Reefs, Shoals and Banks	Bassett-Smith Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Beagle and Dingo Reefs	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Big Bank Shoals	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
Reefs, Shoals and Banks	Branch Banks	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Calder Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Cootamundra Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Deep Shoal 1	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Deep Shoal 2	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	East Holothuria Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Echuca Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Elphinstone Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Eugene McDermott Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
Reefs, Shoals and Banks	Favell Bank	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Fitzpatrick Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Flat Top Bank	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Gale Bank	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Goeree Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	2
Reefs, Shoals and Banks	Goodrich Bank	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
	Heritage Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Heywood Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Hibernia Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Holothuria Banks	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Ingram Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Jabiru Shoals	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Jamieson Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Johnson Bank	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Karmt Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Long Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Mangola Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Marie Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Mermaid Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Moss Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Newby Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Oliver Rock	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Orontes Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Osborn Reefs	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Otway Bank	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Parry Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Pee Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Penguin Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Robroy Reefs	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Rothery Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Sahul Bank	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Sandy Islet	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Scott Reef North	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Scott Reef South	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Shepparton Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Tait Bank	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Tassie Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	The Boxers	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	The Boxers Area	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Van Cloon Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Vee Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	Vulcan Shoal	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	West Holothuria Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Wildcat Reefs	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Woodbine Bank	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
State Waters	Northern Territory Sate Waters	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Western Australia State Waters	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
WA Fisheries	Abalone	1	0.67	< 0.33	20	21	NC	2	297
	Broome Prawn	1	0.67	< 0.33	20	21	NC	2	297
	Kimberley Crab Fishery	40.67	19	5.33	1	1	1	191	8,825
	Kimberley Gillnet and Barramundi	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC
	Kimberley Prawn	0.33	< 0.33	< 0.33	108	NC	NC	<1	12
	Mackerel Fishery	40.67	19	5.33	1	1	1	191	8,825
	Northern Demersal Scalefish	40.67	19	5.33	1	1	1	191	8,825
	Pilbara Crab Fishery	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1
	South West Coast Salmon	40.67	19	5.33	1	1	1	191	8,825
	Specimen Shell	1	0.67	< 0.33	20	21	NC	2	297
	West Coast Deep Sea Crustacean	40.67	19	5.33	1	1	1	191	8,825

NC: No contact to receptor predicted for specified threshold.

§ Probabilities and maximum concentrations calculated at depth of submerged feature.

3.4 Dissolved Aromatic Hydrocarbon

Table 3.4 Potential for exposure to dissolved aromatic hydrocarbons for individual sensitive receptors for Scenario 3. Annualised results.

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
Australian Marine Parks	Argo-Rowley Terrace MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Ashmore Reef MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Cartier Island MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Joseph Bonaparte Gulf MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Kimberley MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Oceanic Shoals MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Biologically Important Areas	Dolphins BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Dugong BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC
	Marine Turtle BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	River Sharks BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Seabirds BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Sharks BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Whales BIA	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Coastlines	Cobourg Peninsula	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Cox-Finniss	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Indonesia	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Joseph Bonaparte Gulf Northern Territory	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Lombok	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Minjilang	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Nusa Tenggara Barat	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1

	Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
Nusa Tenggara Timur	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Sumba Barat	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Sumba Timur	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Sumbawa	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
West Arnhem	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Augereau Island - Combe Hill Point (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Augereau Island - Combe Hill Point (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Augereau Island - Combe Hill Point (C)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Augereau Island - Combe Hill Point (D)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Augereau Island - Davidsons Point	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Battery Point - Cape Wellington	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Battery Point - High Bluff (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Battery Point - High Bluff (C)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Cape Bougainville - Low Island Point (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Cape Bougainville - Low Island Point (C)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Cape Bougainville - Low Island Point (D)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Cape Talbot - Cape Londonderry (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Cape Talbot - Cape Londonderry (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Cape Torrens - Anderdon Islands Point	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1

	Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
Cape Wellington - Cape Torrens (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Cape Wellington - Cape Torrens (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Cape Wellington - Cape Torrens (C)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Cape Wellington - Cape Torrens (D)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Crystal Head - Cape Bougainville	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Davidsons Point - Cape Bougainville (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Davidsons Point - Cape Bougainville (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Davidsons Point - Cape Bougainville (C)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Davidsons Point - Cape Bougainville (D)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Davidsons Point - Crystal Head (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Davidsons Point - Crystal Head (C)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Davidsons Point - Crystal Head (D)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
High Bluff - Cape Wellington (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Low Island Point - Anjo (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Low Island Point - Anjo (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Low Island Point - Anjo (C)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Marnebulorgne Community N Point - Augereau Island (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
	Marnebulorgne Community N Point - Augereau Island (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Marnebulorgne Community N Point - Battery Point (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Scott Reef North	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Scott Reef South	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Swift Bay - Davidsons Point (A)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Swift Bay - Davidsons Point (B)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Exclusive Economic Zone	Australian Exclusive Economic Zone	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5
	Christmas Island Exclusive Economic Zone	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	East Timorian Exclusive Economic Zone	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Indonesian Exclusive Economic Zone	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Fisheries	North-West Slope Trawl Fishery	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5
	Northern Prawn Fishery	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Southern Bluefin Tuna Fishery	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5
	Timor Reef Fishery (NT Managed)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Western Skipjack Fishery	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5
	Western Tuna and Billfish Fishery	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5
Indigenous Prote	Dambimangari	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
	Uunguu	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
IMCRA	Anson Beagle	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Arafura	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Bonaparte Gulf	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Cambridge-Bonaparte	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Cobourg	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Kimberley	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Northwest Shelf	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Oceanic Shoals	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Tiwi	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Van Diemens Gulf	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
IBRA	Cobourg	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Darwin Coastal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Mitchell	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Murgenella	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Timor Sea Coral Islands	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Tiwi	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Islands	Bathurst Island	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Cartier Island	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Croker Island	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Melville Island	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Oxley Island	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Peron Island North	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
	Peron Islands	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Pulau Dana	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Pulau Lahalura	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Pulau Mangudu	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Pulau Ndana	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Pulau Nuse	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Pulau Raijua	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Pulau Rote	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Pulau Sawu	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Key Ecological Features	Ancient Coastline at 125m Depth Contour	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Canyons linking the Argo Abyssal Plain with the Scott Plateau	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Carbonate Bank and Terrace System of the Sahul Shelf	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Carbonate Bank and Terrace System of the Van Diemen Rise	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Continental Slope Demersal Fish Communities	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Pinnacles of the Bonaparte Basin	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
	Shelf Break and Slope of the Arafura Shelf	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Marine Parks	Lalang-garram / Camden Sound MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	North Kimberley MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	North Lalang-garram MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
National Park	Garig Gunak Barlu NP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Prince Regent NP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Nature Reserve	Scott Reef NR	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Ramsar	Cobourg Peninsula	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Reefs, Shoals and Banks	Ashmore Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Baldwin Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Barracouta Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Bassett-Smith Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Beagle and Dingo Reefs	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Big Bank Shoals	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Branch Banks	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Calder Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Cootamundra Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Deep Shoal 1	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Deep Shoal 2	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	East Holothuria Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Echuca Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1

	Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
Elphinstone Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Eugene McDermott Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Favell Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Fitzpatrick Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Flat Top Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Gale Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Goeree Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Goodrich Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Heritage Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Heywood Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Hibernia Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Holothuria Banks	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Ingram Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Jabiru Shoals	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Jamieson Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Johnson Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Karmt Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Long Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Mangola Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Marie Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Mermaid Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Moss Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Newby Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Oliver Rock	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Orontes Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Osborn Reefs	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Otway Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Parry Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
	Pee Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Penguin Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Robroy Reefs	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Rothery Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Sahul Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Sandy Islet	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Scott Reef North	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Scott Reef South	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Shepparton Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Tait Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Tassie Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	The Boxers	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	The Boxers Area	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Van Cloon Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Vee Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Vulcan Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	West Holothuria Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Wildcat Reefs	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Woodbine Bank	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
State Waters	Northern Territory Sate Waters	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Western Australia State Waters	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
WA Fisheries	Abalone	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Broome Prawn	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
	Kimberley Crab Fishery	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5

	Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate spills	in the worst replicate
Kimberley Gillnet and Barramundi	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Kimberley Prawn	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Mackerel Fishery	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5
Northern Demersal Scalefish	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5
Pilbara Crab Fishery	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
South West Coast Salmon	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5
Specimen Shell	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
West Coast Deep Sea Crustacean	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5

NC: No contact to receptor predicted for specified threshold.

§ Probabilities and maximum concentrations calculated at depth of submerged feature.

4 SCENARIO 4: SURFACE RELEASE OF 42,000 M^3 OF PRELUDE CONDENSATE DUE TO COLLISION DURING PRODUCT OFFLOADING

4.1 Floating Oil

Table 4.1 Potential for exposure to floating oil for individual sensitive receptors for Scenario 4 commenced during summer.

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
Australian Marine Parks	Argo-Rowley Terrace MP*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Ashmore Reef MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Cartier Island MP	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Kimberley MP*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Mermaid Reef MP*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Biologically Important Areas	Marine Turtle BIA	0.33	< 0.33	< 0.33	< 0.33	115	NC	NC	NC
	Seabirds BIA	1.33	0.33	< 0.33	< 0.33	61	64	NC	NC
	Sharks BIA	1.33	0.67	< 0.33	< 0.33	64	65	NC	NC
	Whales BIA	2.33	1	< 0.33	< 0.33	103	115	NC	NC
Coastlines	Clerke Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Imperieuse Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Marnebulorgne Community N Point - Augereau Island (B)	0.67	0.33	< 0.33	< 0.33	53	63	NC	NC
	Mermaid Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Scott Reef North	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Scott Reef South	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Exclusive Economic Zone	Australian Exclusive Economic Zone*	100	100	100	100	1	1	1	1
	East Timorian Exclusive Economic Zone*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Indonesian Exclusive Economic Zone*	0.33	< 0.33	< 0.33	< 0.33	294	NC	NC	NC
Fisheries	North-West Slope Trawl Fishery*	100	100	100	100	1	1	1	1
	Southern Bluefin Tuna Fishery	100	100	100	100	1	1	1	1
	Western Skipjack Fishery	100	100	100	100	1	1	1	1
	Western Tuna and Billfish Fishery	100	100	100	100	1	1	1	1
IMCRA	Kimberley*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Northwest Shelf*	0.67	0.33	< 0.33	< 0.33	64	65	NC	NC
	Oceanic Shoals*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
IBRA	Timor Sea Coral Islands*	0.33	< 0.33	< 0.33	< 0.33	114	NC	NC	NC
Islands	Cartier Island	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Key Ecological Features	Ancient Coastline at 125m Depth Contour*	0.33	< 0.33	< 0.33	< 0.33	79	NC	NC	NC
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Canyons linking the Argo Abyssal Plain with the Scott Plateau*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Carbonate Bank and Terrace System of the Sahul Shelf*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Continental Slope Demersal Fish Communities*	7.67	4.33	2	1	9	15	16	16
	Mermaid Reef and Commonwealth Waters surrounding Rowley Shoals	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	0.67	< 0.33	< 0.33	< 0.33	203	NC	NC	NC
Marine Parks	Clerke Reef (Rowley Shoals MP)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Imperieuse Reef (Rowley Shoals MP)	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Nature Reserve	Scott Reef NR	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
Reefs, Shoals and Banks	Ashmore Reef	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Barracouta Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Barton Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Big Bank Shoals*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Clerke Reef*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Dillon Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Echuca Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Eugene McDermott Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Goeree Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Heywood Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Hibernia Reef*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Imperieuse Reef*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Jabiru Shoals*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Johnson Bank*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Karmt Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Mangola Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC

		Highest probability (%) of floating oil contacting a receptor cell at				Minimum time (hours) for contact by floating oil at			
		≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²	≥ 1 g/m²	≥ 10 g/m²	≥ 50 g/m²	≥ 100 g/m²
	Mermaid Reef*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Pee Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Sahul Bank*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Sandy Islet	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Scott Reef North*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Scott Reef South	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Seringapatam Reef*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Vee Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Vulcan Shoal*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Woodbine Bank*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
State Waters	Western Australia State Waters*	0.67	0.33	< 0.33	< 0.33	64	65	NC	NC
WA Fisheries	Abalone*	2	1.33	< 0.33	< 0.33	44	60	NC	NC
	Broome Prawn*	2	1.33	< 0.33	< 0.33	44	60	NC	NC
	Kimberley Crab Fishery*	100	100	100	100	1	1	1	1
	Kimberley Prawn*	0.67	0.33	< 0.33	< 0.33	80	114	NC	NC
	Mackerel Fishery*	100	100	100	100	1	1	1	1
	Nickol Bay Prawn*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Northern Demersal Scalefish*	100	100	100	100	1	1	1	1
	Pilbara Crab Fishery*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Pilbara Fish Trawl*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	Pilbara Trap*	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC
	South West Coast Salmon*	100	100	100	100	1	1	1	1
	Specimen Shell*	2	1.33	< 0.33	< 0.33	44	60	NC	NC
	West Coast Deep Sea Crustacean*	100	100	100	100	1	1	1	1

NC: No contact to receptor predicted for specified threshold. NA: Not applicable

* Floating oil will not accumulate on submerged features and at open ocean locations.

4.2 Shoreline Oil Accumulation

Table 4.2 Potential for accumulation of oil onto shoreline receptors if Scenario 4 commenced during summer. Calculations are for peak oil accumulation over time in any simulation for each receptor.

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
Australian Marine Parks	Argo-Rowley Terrace MP*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ashmore Reef MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Cartier Island MP	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Kimberley MP*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mermaid Reef MP*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Biologically Important	Marine Turtle BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Seabirds BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Sharks BIA	0.67	0.33	0.33	113	114	138	6	1,507	<1	50	<1	50	<1	34	<1	4	<1	4	<1	2
	Whales BIA	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Coastlines	Clerke Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Imperieuse Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Marnebulorgne Community N Point - Augereau Island (B)	0.67	0.33	0.33	113	114	138	6	1,507	<1	50	<1	50	<1	34	<1	4	<1	4	<1	2
	Mermaid Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Scott Reef North	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Scott Reef South	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Seringapatam Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Exclusive Economic Zone	Australian Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	East Timorian Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Indonesian Exclusive Economic Zone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fisheries	North-West Slope Trawl Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Southern Bluefin Tuna Fishery	0.67	0.33	0.33	113	114	138	6	1,507	<1	50	<1	50	<1	34	<1	4	<1	4	<1	2
	Western Skipjack Fishery	0.67	0.33	0.33	113	114	138	6	1,507	<1	50	<1	50	<1	34	<1	4	<1	4	<1	2
	Western Tuna and Billfish Fishery	0.67	0.33	0.33	113	114	138	6	1,507	<1	50	<1	50	<1	34	<1	4	<1	4	<1	2
IMCRA	Kimberley*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Northwest Shelf*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
	Oceanic Shoals*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
IBRA	Timor Sea Coral Islands*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Islands	Cartier Island	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Key Ecological Features	Ancient Coastline at 125m Depth Contour*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Canyons linking the Argo Abyssal Plain with the Scott Plateau*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Carbonate Bank and Terrace System of the Sahul Shelf*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Continental Slope Demersal Fish Communities*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mermaid Reef and Commonwealth Waters surrounding Rowley Shoals	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Marine Parks	Clerke Reef (Rowley Shoals MP)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Imperieuse Reef (Rowley Shoals MP)	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nature Reserve	Scott Reef NR	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Reefs, Shoals and Banks	Ashmore Reef	< 0.33	< 0.33	< 0.33	NC	NC	NC	<1	<1	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Barracouta Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Barton Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Big Bank Shoals*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Clerke Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dillon Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Echuca Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

		Highest probability (%) of oil accumulating on any shoreline cell at			Minimum time (hours) for accumulation on shoreline at			Maximum accumulated concentration on any shoreline cell (g/m²)		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 10 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 100 g/m²		Maximum accumulated volume (m³) along receptor shoreline with concentrations ≥ 1,000 g/m²		Maximum length of shoreline (km) with concentrations ≥ 10 g/m²		Maximum length of shoreline (km) with concentrations ≥ 100 g/m²		Maximum length of shoreline (km) with concentrations ≥ 1,000 g/m²	
		≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill	averaged over all replicate spills	in the worst replicate spill
	Eugene McDermott Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Goeree Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Heywood Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Hibernia Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Imperieuse Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Jabiru Shoals*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Johnson Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Karmt Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mangola Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mermaid Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pee Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sahul Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Sandy Islet	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Scott Reef North*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Scott Reef South	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
	Seringapatam Reef*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Vee Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Vulcan Shoal*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Woodbine Bank*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
State Waters	Western Australia State Waters*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
WA Fisheries	Abalone*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Broome Prawn*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kimberley Crab Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kimberley Prawn*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mackerel Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Nickol Bay Prawn*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Northern Demersal Scalefish*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pilbara Crab Fishery*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pilbara Fish Trawl*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pilbara Trap*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	South West Coast Salmon*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Specimen Shell*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	West Coast Deep Sea Crustacean*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NC: No contact to receptor predicted for specified threshold. NA: Not applicable

* Floating oil will not accumulate on submerged features and at open ocean locations

4.3 Entrained Oil

Table 4.3 Potential for exposure to entrained oil for individual sensitive receptors if Scenario 4 commenced during summer.

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
Australian Marine Parks	Argo-Rowley Terrace MP	4	0.33	< 0.33	451	567	NC	2	137
	Ashmore Reef MP	6.67	1.33	< 0.33	265	553	NC	4	199
	Cartier Island MP	6.67	0.67	< 0.33	224	339	NC	4	645
	Kimberley MP	8.67	3	0.33	175	177	199	15	1,633
	Mermaid Reef MP	0.67	< 0.33	< 0.33	762	NC	NC	<1	27
Biologically Important Areas	Marine Turtle BIA	10.33	2.67	0.33	114	185	316	15	1,152
	Seabirds BIA	24.33	12.67	2.67	62	68	70	69	5,443
	Sharks BIA	20	10.33	2.67	27	29	30	161	17,337
	Whales BIA	24.67	11.67	3	76	77	79	89	8,167
Coastlines	Clerke Reef	0.33	< 0.33	< 0.33	820	NC	NC	<1	43
	Imperieuse Reef	1	< 0.33	< 0.33	904	NC	NC	<1	31
	Marnebulorgne Community N Point - Augereau Island (B)	11	5	1	64	78	115	24	1,418
	Mermaid Reef	0.67	< 0.33	< 0.33	820	NC	NC	<1	23
	Scott Reef North	10.33	3	0.33	211	219	312	11	1,246
	Scott Reef South	9	2.67	0.33	211	220	312	11	1,155
	Seringapatam Reef	13.67	4	< 0.33	192	197	NC	12	788
Exclusive Economic Zone	Australian Exclusive Economic Zone	91	73.67	55.67	1	1	1	29,783	889,327
	East Timorian Exclusive Economic Zone	0.67	< 0.33	< 0.33	778	NC	NC	<1	45
	Indonesian Exclusive Economic Zone	15.67	4.67	0.33	161	164	176	20	1,727
Fisheries	North-West Slope Trawl Fishery	91	73.67	55.67	1	1	1	29,783	889,327
	Southern Bluefin Tuna Fishery	91	73.67	55.67	1	1	1	29,783	889,327
	Western Skipjack Fishery	91	73.67	55.67	1	1	1	29,783	889,327
	Western Tuna and Billfish Fishery	91	73.67	55.67	1	1	1	29,783	889,327
IMCRA	Kimberley	0.33	< 0.33	< 0.33	621	NC	NC	<1	26
	Northwest Shelf	20	10.33	2.67	24	25	31	154	17,337
	Oceanic Shoals	7.67	2.33	0.33	84	99	120	12	3,020
IBRA	Timor Sea Coral Islands	8	3.33	0.33	103	150	257	17	1,162

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
Islands	Cartier Island	6.67	0.33	< 0.33	233	351	NC	4	645
Key Ecological Features	Ancient Coastline at 125m Depth Contour	18	10.33	2.67	30	31	31	141	16,237
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	7.33	1.33	< 0.33	224	244	NC	5	686
	Canyons linking the Argo Abyssal Plain with the Scott Plateau	2.33	< 0.33	< 0.33	559	NC	NC	<1	39
	Carbonate Bank and Terrace System of the Sahul Shelf	3.33	0.33	< 0.33	374	598	NC	2	190
	Continental Slope Demersal Fish Communities	42.67	30	18.67	9	10	12	1,155	49,521
	Mermaid Reef and Commonwealth Waters surrounding Rowley Shoals	1	< 0.33	< 0.33	738	NC	NC	<1	50
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	13.67	4.33	0.33	188	197	306	13	1,246
Marine Parks	Clerke Reef (Rowley Shoals MP)	0.33	< 0.33	< 0.33	810	NC	NC	<1	43
	Imperieuse Reef (Rowley Shoals MP)	1	< 0.33	< 0.33	901	NC	NC	<1	32
Nature Reserve	Scott Reef NR	9.33	3	0.33	210	219	312	11	1,246
Reefs, Shoals and Banks	Ashmore Reef	6.33	1.33	< 0.33	310	557	NC	4	199
	Barracouta Shoal	4	< 0.33	< 0.33	288	NC	NC	2	89
	Barton Shoal	0.67	< 0.33	< 0.33	810	NC	NC	<1	41
	Big Bank Shoals	0.33	< 0.33	< 0.33	921	NC	NC	<1	44
	Clerke Reef	0.33	< 0.33	< 0.33	822	NC	NC	<1	38
	Dillon Shoal	0.67	< 0.33	< 0.33	892	NC	NC	<1	14
	Echuca Shoal	3.67	0.67	< 0.33	229	252	NC	2	150
	Eugene McDermott Shoal	3	1	< 0.33	326	338	NC	3	313
	Goeree Shoal	5	2.33	< 0.33	183	195	NC	9	628
	Heywood Shoal	6	0.67	< 0.33	146	349	NC	4	387
	Hibernia Reef	2.33	< 0.33	< 0.33	328	NC	NC	<1	53
	Imperieuse Reef	0.67	< 0.33	< 0.33	914	NC	NC	<1	30
	Jabiru Shoals	2.33	0.33	< 0.33	429	472	NC	2	161
	Johnson Bank	6.67	1	< 0.33	251	254	NC	5	641
	Karmt Shoal	0.67	< 0.33	< 0.33	882	NC	NC	<1	42
	Mangola Shoal	2	0.33	< 0.33	438	481	NC	<1	141

		Highest probability (%) of entrained oil contacting a receptor cell at			Minimum time (hours) for contact by entrained oil at			Maximum entrained oil concentration (ppb)	
		≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	≥ 10 ppb	≥ 100 ppb	≥ 1,000 ppb	averaged over all replicate spills	in the worst replicate spill
	Mermaid Reef	0.67	< 0.33	< 0.33	823	NC	NC	<1	20
	Pee Shoal	2.33	< 0.33	< 0.33	680	NC	NC	<1	57
	Sahul Bank	2	0.33	< 0.33	465	684	NC	<1	115
	Sandy Islet	6.67	1.33	< 0.33	253	379	NC	5	767
	Scott Reef North	11	3	< 0.33	200	217	NC	8	454
	Scott Reef South	10.33	3	0.33	205	210	306	11	1,246
	Seringapatam Reef	13.67	4	< 0.33	192	198	NC	12	790
	Vee Shoal	1.33	< 0.33	< 0.33	463	NC	NC	<1	35
	Vulcan Shoal	5	1.67	< 0.33	196	207	NC	8	542
	Woodbine Bank	5.67	1	< 0.33	253	260	NC	4	275
State Waters	Western Australia State Waters	10.33	4	0.33	91	102	234	20	1,250
WA Fisheries	Abalone	25.33	14	4.33	20	20	20	270	32,972
	Broome Prawn	25.33	14	4.33	20	20	20	270	32,972
	Kimberley Crab Fishery	91	73.67	55.67	1	1	1	29,783	889,327
	Kimberley Prawn	12.33	4	2	57	58	60	48	6,612
	Mackerel Fishery	91	73.67	55.67	1	1	1	29,783	889,327
	Nickol Bay Prawn	0.33	< 0.33	< 0.33	728	NC	NC	<1	15
	Northern Demersal Scalefish	91	73.67	55.67	1	1	1	29,783	889,327
	Pilbara Crab Fishery	3.67	0.33	< 0.33	405	483	NC	2	190
	Pilbara Fish Trawl	0.33	< 0.33	< 0.33	728	NC	NC	<1	15
	Pilbara Trap	0.33	< 0.33	< 0.33	728	NC	NC	<1	15
	South West Coast Salmon	91	73.67	55.67	1	1	1	29,783	889,327
	Specimen Shell	25.33	14	4.33	20	20	20	270	32,972
	West Coast Deep Sea Crustacean	91	73.67	55.67	1	1	1	29,783	889,327

NC: No contact to receptor predicted for specified threshold.

§ Probabilities and maximum concentrations calculated at depth of submerged feature.

4.4 Dissolved Aromatic Hydrocarbon

Table 4.4 Potential for exposure to dissolved aromatic hydrocarbons for individual sensitive receptors if Scenario 4 commenced during summer.

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate simulations	in the worst replicate simulation
Australian Marine Parks	Argo-Rowley Terrace MP	0.67	0.33	0.33	< 0.33	564	565	619	NC	<1	57
	Ashmore Reef MP	1.67	1.33	0.33	< 0.33	237	295	331	NC	<1	110
	Cartier Island MP	1	0.67	0.33	< 0.33	329	337	362	NC	<1	55
	Kimberley MP	3.67	3	1.33	0.67	184	187	189	268	4	721
	Mermaid Reef MP	0.33	0.33	< 0.33	< 0.33	781	800	NC	NC	<1	18
Biologically Important Areas	Marine Turtle BIA	3.33	2.33	1	< 0.33	132	132	234	NC	2	287
	Seabirds BIA	10.33	9.33	4	1.33	71	72	73	78	12	2,777
	Sharks BIA	10	9	4	2	30	31	31	35	77	22,288
	Whales BIA	11	8.67	4.33	1.67	80	80	80	83	23	5,284
Coastlines	Clerke Reef	0.33	0.33	< 0.33	< 0.33	849	849	NC	NC	<1	18
	Imperieuse Reef	0.33	0.33	< 0.33	< 0.33	973	1,001	NC	NC	<1	13
	Marnebulorgne Community N Point - Augereau Island (B)	5.33	4	1.67	0.33	108	108	108	118	5	878
	Mermaid Reef	0.33	0.33	< 0.33	< 0.33	781	841	NC	NC	<1	11
	Scott Reef North	2	1.67	0.33	< 0.33	235	237	304	NC	<1	147
	Scott Reef South	2.67	1.67	0.67	< 0.33	292	292	309	NC	<1	155
	Seringapatam Reef	3	2.67	1	0.33	187	187	191	232	3	586
Exclusive Economic Zone	Australian Exclusive Economic Zone	84.33	82	61.33	41.33	1	1	1	1	2,712	126,158
	East Timorian Exclusive Economic Zone	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate simulations	in the worst replicate simulation
	Indonesian Exclusive Economic Zone	5.33	3.67	1.67	0.33	168	168	173	205	5	830
Fisheries	North-West Slope Trawl Fishery	84.33	82	61.33	41.33	1	1	1	1	2,712	126,158
	Southern Bluefin Tuna Fishery	84.33	82	61.33	41.33	1	1	1	1	2,712	126,158
	Western Skipjack Fishery	84.33	82	61.33	41.33	1	1	1	1	2,712	126,158
	Western Tuna and Billfish Fishery	84.33	82	61.33	41.33	1	1	1	1	2,712	126,158
IMCRA	Kimberley	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Northwest Shelf	10	9	4	2	31	31	31	34	77	22,288
	Oceanic Shoals	1.67	1.33	0.67	0.33	121	122	123	130	4	720
IBRA	Timor Sea Coral Islands	3.67	2.67	1.33	< 0.33	131	131	131	NC	2	159
Islands	Cartier Island	0.33	0.33	< 0.33	< 0.33	359	360	NC	NC	<1	22
Key Ecological Features	Ancient Coastline at 125m Depth Contour	9	8.67	4	2	31	32	32	37	57	14,027
	Ashmore Reef and Cartier Island and surrounding Commonwealth Waters	1.67	1.33	0.67	< 0.33	181	254	256	NC	<1	166
	Canyons linking the Argo Abyssal Plain with the Scott Plateau	0.33	< 0.33	< 0.33	< 0.33	783	NC	NC	NC	<1	8
	Carbonate Bank and Terrace System of the Sahul Shelf	0.67	0.33	< 0.33	< 0.33	601	619	NC	NC	<1	30
	Continental Slope Demersal Fish Communities	29.33	26.67	18.67	8	13	13	14	14	200	19,914

		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate simulations	in the worst replicate simulation
	Mermaid Reef and Commonwealth Waters surrounding Rowley Shoals	0.33	0.33	< 0.33	< 0.33	742	786	NC	NC	<1	18
	Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex	3.67	3	1	0.33	188	189	191	239	2	424
Marine Parks	Clerke Reef (Rowley Shoals MP)	0.33	0.33	< 0.33	< 0.33	843	848	NC	NC	<1	18
Marine Parks	Imperieuse Reef (Rowley Shoals MP)	0.33	0.33	< 0.33	< 0.33	978	1,001	NC	NC	<1	13
Nature Reserve	Scott Reef NR	2.67	1.67	0.33	< 0.33	246	287	304	NC	<1	109
Reefs, Shoals and Banks	Ashmore Reef	1.67	1.33	0.33	< 0.33	237	297	336	NC	<1	89
Reefs, Shoals and Banks	Barracouta Shoal	0.67	0.33	< 0.33	< 0.33	591	592	NC	NC	<1	40
Reefs, Shoals and Banks	Barton Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Reefs, Shoals and Banks	Big Bank Shoals	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Reefs, Shoals and Banks	Clerke Reef	0.33	0.33	< 0.33	< 0.33	851	851	NC	NC	<1	17
Reefs, Shoals and Banks	Dillon Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
Reefs, Shoals and Banks	Echuca Shoal	0.67	0.33	0.33	< 0.33	204	204	205	NC	<1	252
Reefs, Shoals and Banks	Eugene McDermott Shoal	0.67	0.67	0.33	< 0.33	348	362	369	NC	<1	62
Reefs, Shoals and Banks	Goeree Shoal	1.33	1.33	0.67	< 0.33	214	215	266	NC	<1	144
Reefs, Shoals and Banks	Heywood Shoal	0.67	0.67	0.33	< 0.33	351	373	486	NC	<1	59
Reefs, Shoals and Banks	Hibernia Reef	1	0.67	< 0.33	< 0.33	373	376	NC	NC	<1	23
Reefs, Shoals and Banks	Imperieuse Reef	0.33	0.33	< 0.33	< 0.33	985	1,001	NC	NC	<1	13
Reefs, Shoals and Banks	Jabiru Shoals	0.33	0.33	< 0.33	< 0.33	491	494	NC	NC	<1	18
Reefs, Shoals and Banks	Johnson Bank	1	1	0.33	< 0.33	260	260	263	NC	<1	73
Reefs, Shoals and Banks	Karmt Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	2
Reefs, Shoals and Banks	Mangola Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	5
Reefs, Shoals and Banks	Mermaid Reef	0.33	0.33	< 0.33	< 0.33	815	831	NC	NC	<1	11

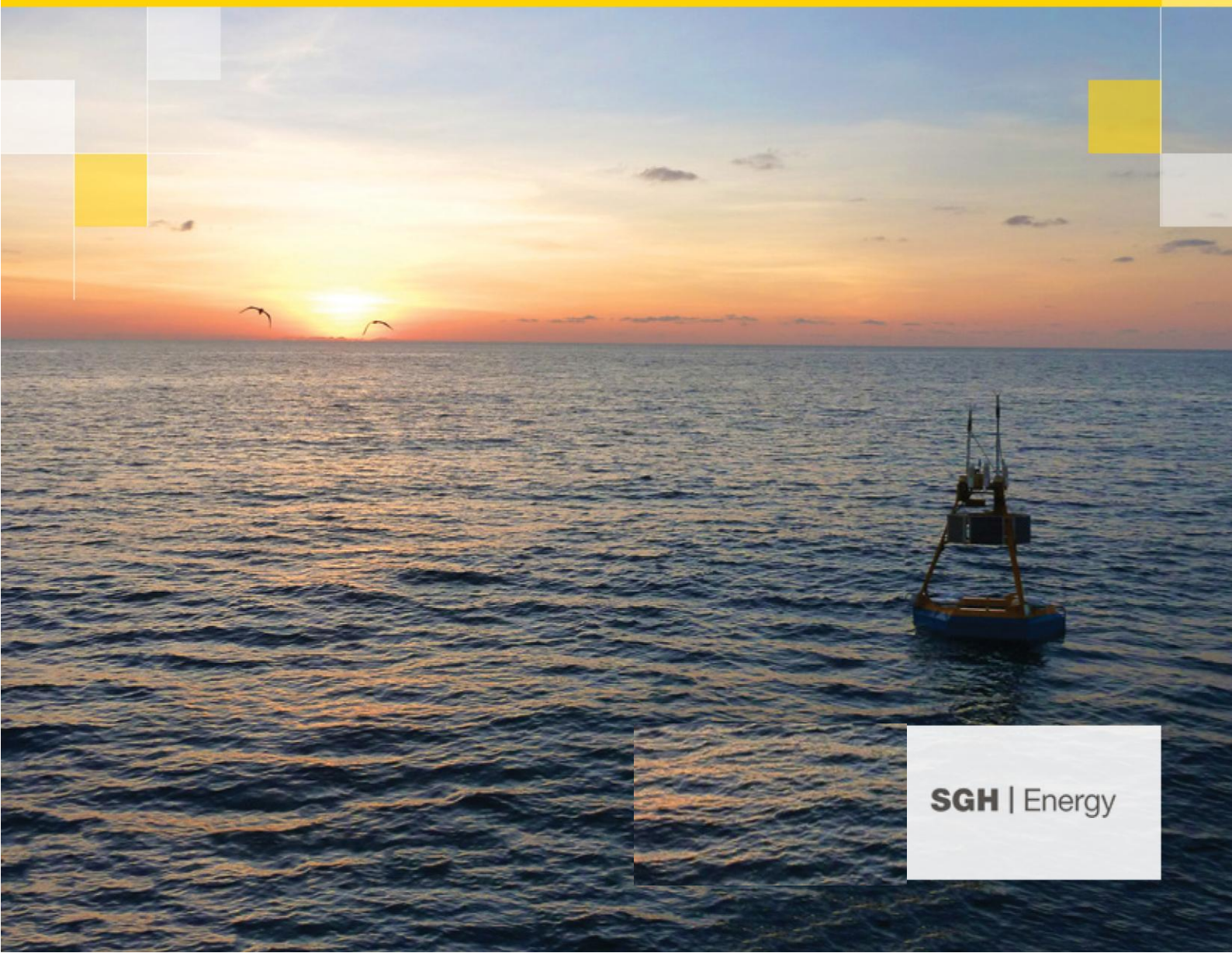
		Highest probability (%) of dissolved hydrocarbons contacting a receptor cell at				Minimum time (hours) for contact by dissolved hydrocarbons at				Maximum dissolved aromatic hydrocarbon concentration (ppb)	
		≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 6 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	averaged over all replicate simulations	in the worst replicate simulation
	Pee Shoal	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	6
	Sahul Bank	0.67	< 0.33	< 0.33	< 0.33	650	NC	NC	NC	<1	10
	Sandy Islet	1	1	0.33	< 0.33	386	394	434	NC	<1	109
	Scott Reef North	2	1.33	0.33	< 0.33	224	225	343	NC	<1	171
	Scott Reef South	2.67	1.67	0.67	< 0.33	228	229	289	NC	2	216
	Seringapatam Reef	3	2.67	1	0.33	187	187	191	232	3	586
	Vee Shoal	0.67	0.33	< 0.33	< 0.33	462	465	NC	NC	<1	23
	Vulcan Shoal	1.67	1.67	0.33	< 0.33	245	256	260	NC	<1	87
	Woodbine Bank	1.33	1	0.33	< 0.33	362	362	370	NC	<1	94
State Waters	Western Australia State Waters	5	3.67	1.67	0.33	119	119	120	121	4	604
WA Fisheries	Abalone	14	13	7.67	2.67	20	20	21	22	104	24,550
	Broome Prawn	14	13	7.67	2.67	20	20	21	22	104	24,550
	Kimberley Crab Fishery	84.33	82	61.33	41.33	1	1	1	1	2,712	126,158
	Kimberley Prawn	5.33	3.67	2.33	0.67	60	61	68	85	9	2,134
	Mackerel Fishery	84.33	82	61.33	41.33	1	1	1	1	2,712	126,158
	Nickol Bay Prawn	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Northern Demersal Scalefish	84.33	82	61.33	41.33	1	1	1	1	2,712	126,158
	Pilbara Crab Fishery	0.67	0.33	0.33	< 0.33	493	496	531	NC	<1	91
	Pilbara Fish Trawl	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	Pilbara Trap	< 0.33	< 0.33	< 0.33	< 0.33	NC	NC	NC	NC	<1	<1
	South West Coast Salmon	84.33	82	61.33	41.33	1	1	1	1	2,712	126,158
	Specimen Shell	14	13	7.67	2.67	20	20	21	22	104	24,550
	West Coast Deep Sea Crustacean	84.33	82	61.33	41.33	1	1	1	1	2,712	126,158

NC: No contact to receptor predicted for specified threshold.

§ Probabilities and maximum concentrations calculated at depth of submerged feature.

Appendix F Adaptive Monitoring and Management Framework

Prelude Produced Water Adaptive Monitoring and Management Framework (AMMF)



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Prelude Produced Water Adaptive Monitoring and Management Framework (AMMF)

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1 Introduction

The Prelude Produced Water Adaptive Monitoring and Management Framework (AMMF) sets out Shell Australia's strategy for managing the environmental risks associated with produced water (PW) discharges from the Prelude FLNG facility. The AMMF has been developed to align with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018; 2023), while also meeting Shell's internal requirements for water stewardship under the SEAM Standards and the International Water Stewardship Standard (AWS, 2019).

Outcomes and recommendations from the PW monitoring and adaptive management actions conducted in accordance with the previous Prelude FLNG Operations Environment Plan (refer to Section 9.9 of the current EP), have been critical to the development of this AMMF. Key monitoring methods used in the AMMF include Direct Toxicity Assessment (DTA), chemical characterisation, mechanistic toxicity modelling, and sediment monitoring.

The AMMF is designed to be iterative and responsive, with built-in mechanisms for continuous improvement. Monitoring results and new information will inform future updates, ensuring that environmental risks are managed to ALARP and acceptable levels. The AMMF supports the broader Prelude FLNG Operations Environment Plan and demonstrates Shell's commitment to responsible environmental management.

2 Context

The AMMF, consistent with the approach defined in the Australian and New Zealand Governments (ANZG) Guidelines for Fresh and Marine Water Quality (2018), is a continuous cycle of improvement. It involves setting environmental performance objectives (EPOs), developing and implementing management measures and measuring results. The results from monitoring are then fed back into new EPOs, management measures, and actions, which will be detailed in subsequent EP 5 yearly revisions submitted to NOPSEMA. This approach ensures that management measures are updated appropriately based on new information and changing conditions, allowing for more effective and responsive management of the PW discharge.

The steps outlined in the ANZG Water Quality Management Framework have been adapted to suit the OPGGS (Environment) regulatory regime, as part of Shell's AMMF for Prelude (Figure , ANZG 2018).

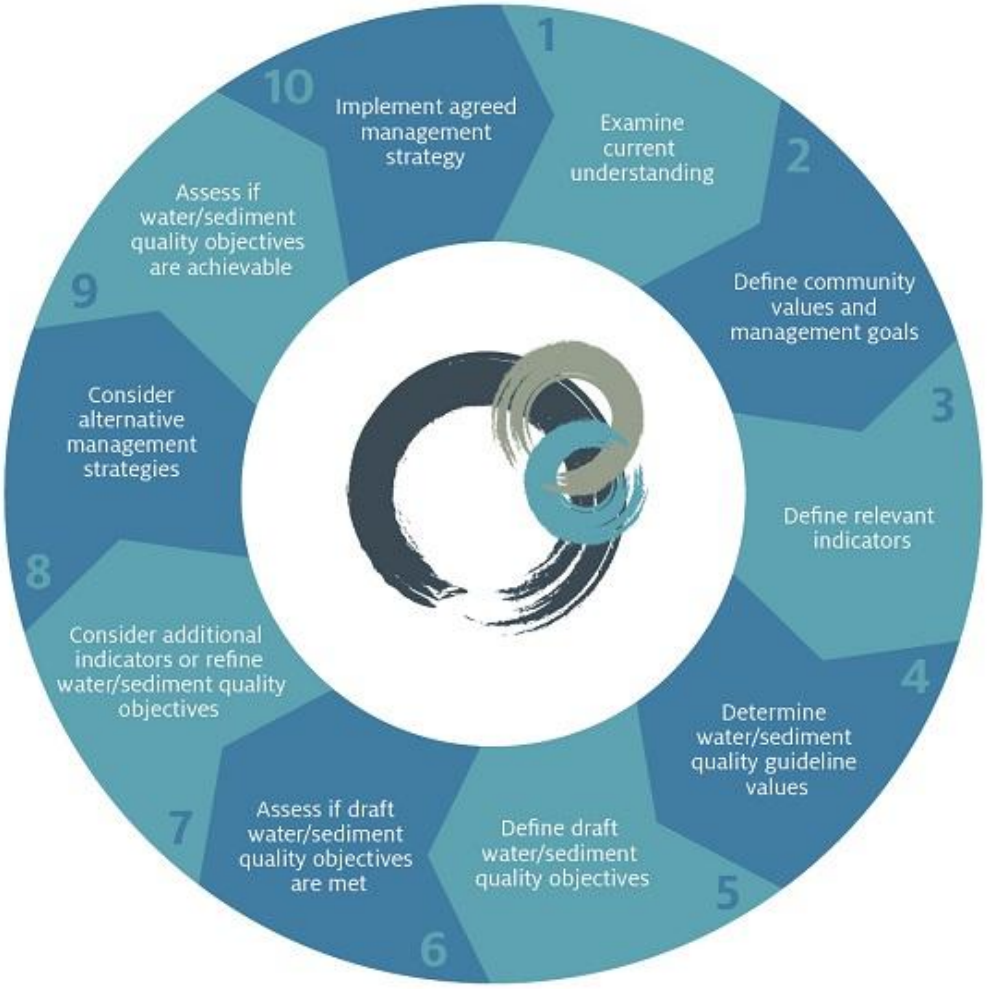

Figure 2-1 Prelude Produced Water Adaptive Management Framework – Based off Water Quality Management Framework (ANZG 2018)

Shell requires a water stewardship management plan which adopts of the principles from the AWS (2019), where relevant. These principles and their consideration include:

- Adopt Good Water Governance - The AWS outcome of Good Water Governance ensures responsible sharing of water resources in the interests of users and the natural environment in line with the principles of water stewardship.
- Prelude actively demonstrates the outcomes of good water governance through existing engagements with relevant persons associated with preparing this AMMF and EP and local authorities as required through the EP consultation process. The management of water resources in the offshore environment is limited to discharge water quality. As a result, Good Water Governance is not further considered in this AMMF;
- Implement a Sustainable Water Balance – not relevant for Prelude activity due to offshore location and no importation of water;
- Ensure Good Water Quality - There are several liquid discharges associated with operating the Prelude FLNG facility, all of which are regulated by NOPSEMA via the in-force EP, including this AMMF. The AMMF conforms with the ANZG Water Quality Management Framework, and the EP (refer to EP section 9.9) provides a detailed environmental risk and impact evaluation to determine the environmental management frameworks and commitments that need to be implemented to comply with the OPGGS Regulations. The EP, supported by this AMMF, demonstrates that risks are reduced to ALARP and acceptable levels for PW, whilst stipulating good practice in understanding and risk assessing water

quality, and continuous improvement through the adaptive management steps. The outcome of Good Water Quality is therefore a consideration of the AMMF.

- Focus on Important Water-related Areas (IWRA) – not relevant for the Prelude activity due to offshore location and no importation of water. It is not an important water-related area;
- Ensure Safe Water Sanitation and Hygiene for all (WASH) – this applies. Prelude ensures that the facility and operations are compliant and in accordance with national regulations and requirements that ensure safe access to water, hygiene and sanitation. The Prelude FLNG facility already meets the requirements of the WASH principle and therefore it is not further considered in this AMMF.

2.1 Management Goals

The management goals for the PW discharge all aim to ensure impacts on defined values remain below the defined acceptable levels of impact as defined in the EP Table 8-4. The specific management goals (Environmental Performance Outcomes (EPOs)) for Prelude PW discharge are:

- **EPO 2.1** – No injury or mortality of threatened, migratory or cetacean species associated with the Activities
- **EPO 7.1** – No impact to water quality outside of the Mixing Zone Boundary from the discharge of produced water
- **EPO 7.2** – Potential precipitation of toxicants from the PW discharge will not exceed toxicant default guideline values for sediment quality (ANZG) outside the impact zone for sediment, except where pre-operations baseline monitoring potentially shows exceedance already (ANZG).

3 Produced Water Monitoring

3.1 Routine Monitoring

Monitoring of PW TPH concentration, mercury, physio-chemical stressors, toxicants and whole of effluent (DTA) toxicity is important to verify that targets and limits of PW discharge are met and that impacts from the PW discharge are within acceptable levels and comply with environmental performance outcomes. Required routine monitoring of PW during the Activity is presented in ***Table 3-1***.

Table 3-1 Routine Produced Water Monitoring

Parameter	Equipment/Method	Frequency	Comments
Flow Rate	Flow meter Engineering calculations Proactive Technical Monitoring	Continuous	Flow rate is reviewed as part of PTM.
TPH Concentration	Online analyser	Continuous online reading If unavailable – manual sampling to occur every 12hrs	TPH concentration is reviewed as part of PTM.
Chemical Characterisation	ANZG 2018 PMR requirements	Quarterly – at same time as DTAs (both 2pp. and full suite)	Measured at same time as DTAs with a subset of parameters required for quarterly PMR reporting. Monitors physio-chemical stressors such as metals, ammonia, OIW, residual process chemicals in the PW. Verifies PW TPH concentrations from the online analyser and onboard laboratory sampling of TPH and mercury in PW. Parameters tested are summarised in Table 3-2. Supports adaptive management actions.

Parameter	Equipment/Method	Frequency	Comments
Mercury Concentration	Onboard laboratory sampling and analysis	Every 2 weeks at the inlet to the MPPE during Prelude only production. Weekly for the first 12 months following the introduction of Crux gas. Outlet of the MPPE if triggered.	Sampling is conducted by the onboard laboratory with a limit of detection of 0.5 µg/L. Mercury is also monitored quarterly as part of the quarterly Chemical Characterisation monitoring.
Direct Toxicity Assessment (DTA) – full suite (9-11 species)	-	Year 1 – Twice Year 2-5 – Annually, or as triggered	Two full suite DTA tests to be conducted in the first year to establish consistency in sample chemical characterisation – confirmed with chem. characterisation results and mechanistic modelling.
2 species Direct Toxicity Assessment	-	Year 1 - Two times Years 2-5 – Three times per year	Utilising Control Charts to support adaptive management. If results are outside of control limits, trigger mechanistic modelling to inform risk assessment and adaptive management. If subsequent sampling is also outside of control limits, this triggers a full suite DTA with mechanistic modelling.
Mechanistic Modelling	-	Year 1 – Twice together with full Year 1 – Done together with full suite DTA. Year 2-5 – If triggered.	Undertaken together with full suite DTA tests conducted during Year 1 and then if triggered as part of adaptive management. Assists with operational management and risk assessments.
Sediment Monitoring	-	Before 2030	Verify the predicted level of impacts to sediment quality immediately surrounding the Prelude FLNG facility from the PW discharge through field measurements. To be conducted together with Crux sediment monitoring before 2030.

3.2 Produced Water Chemical Characterisation

Full chemical characterisation of PW samples will be conducted quarterly, aligned with DTA testing, to identify constituents likely contributing to toxicity and support adaptive management actions, where triggered (***Table 3-2***). This will include estimation of relative toxic units to support interpretation of toxicity trends. Integrating this analysis into the quarterly topsides assessment will improve the robustness of trend evaluation and enable timely adaptive management responses when trigger thresholds are exceeded. Where specific parameters consistently return nil results over multiple stable sampling rounds, and where third-party subject matter experts advise that their continued inclusion is not an efficient use of resources, these parameters may be removed from future analyses.

Table 3-2 Produced Water Chemical Characterisation Analytes and Limit of Reporting (LOR)

	Analyte	Reference Method	LOR
1	pH	APHA 4500H	0.1 pH units

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	Analyte	Reference Method	LOR
2	Conductivity	APHA 2510 B	2 µS/cm
3	Salinity	Calculation	2 mg/L
4	Biochemical Oxygen Demand (cBOD)	APHA 5210	5 mg/L
5	Total Organic Carbon	APHA 5310 B	200 µg/L
6	Total Dissolved Carbon	APHA 5310 B	200 µg/L
7	Total Kjeldahl Nitrogen	APHA 4500 Norg	50 µg/L
8	Ammonia, low level	APHA 4500 NH3	10 µg/L
9	Cyanide (total)	ISO14403:2002	4 µg/L
10	Sulphide	APHA 4500 S2-	100 µg/L
11	Dissolved Metals†	USEPA6020A & APHA	0.1-10 µg/L
12	Dissolved Mercury	3112B	0.05 µg/L
13	Oil and Grease + Hydrocarbons	APHA 3112	5mg/L
14	NOR (Ra-226, Ra-228, Pb-210, Po-210, Th-232, -total)[1]	APHA 5520	0.05-0.1 Bq/L
15	NOR (U-232, -235, -238, -total)[2]		0.05-0.1 Bq/L
16	VOC (incl. BTEXN, other MAH, and organic solvents)		0.5-20 µg/L
17	VOC scan for 8260 and unknowns	USEPA 8260	various
18	Speciated phenols	USEPA 8260	0.5-50 µg/L
19	PAH-low level (selected ion monitoring mode)	USEPA 8270	0.005-0.02 µg/L
20	SVOC scan for 8270 and unknowns	USEPA 8270	various
21	TRH C6-C40	USEPA 8270	10-50 µg/L
22	TRH Silica Gel >C10-C40 - low level	USEPA 8260/8270	10-50 µg/L
23	Carboxylic acids	USEPA 8270	1000 µg/L
24	Methyldiethanolamine, Piperazine		0.1/0.01 mg/L
25	Methanol, Ethanol		1000 µg/L
26	Glycols		2000 µg/L
27	Phosphonates		
28	Tetrakis hydroxymethyl phosphonium sulphate (THPS)		
29	Microtox®		

†Al, As, Ba, Be, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, Ni, Se, U, Zn

Chemical characterisation of PW will be undertaken by a National Association of Testing Authorities (NATA) accredited laboratory unless not deemed appropriate in order to monitor to the required low level of detection and accuracy needed for mercury lab analysis.

[1] Annual only.
[2] Annual only.

3.3 Direct Toxicity Assessment (DTA)

The primary method for determining and monitoring the potential environmental effects of the PW discharge will be Direct Toxicity Testing (DTA), often also referred to as Whole of Effluent Toxicity (WET) testing. ANZG (2018) recommends DTA as a useful technique for assessing the effects of mixtures of compounds in ambient waters (ANZG 2023), and it is readily applicable to the assessment of potential effects attendant to the Prelude PW discharge. DTA is a well-established approach in ecotoxicology that has generally been adapted from conventional single-chemical toxicity testing approaches, using similar methods, species selection and extrapolation to receiving waters (Mount 1986). DTA differs from single-chemical toxicity testing in that the combined effects of, and interactions between, a number of compounds of unknown identity and concentration are assessed, as opposed to the effects of just one chemical (ANZG 2023).

The major benefit of DTA is that it can assess the toxicity of waters, in which the number of unidentified components may number thousands, and their behaviour, or interactions, cannot be predicted (de Vlaming et al 2000). The effects of complex mixtures cannot usually be predicted by determining the toxicity of individual components, which typically change with time and are often not fully known (Holdway 1992). Thus, DTA enables a greater understanding of potential impacts to aquatic environments, which in turn aids in adaptive management actions which may be considered for adoption (Van Dam and Chapman 2001).

Full suite (11 species) DTA of PW will be carried out twice in the first year (2026) and then annually for the remaining duration this EP revision is in force. This will occur at a suitable point sometime within the calendar year during steady state operations to ensure that a representative sample of the PW is taken. An additional reduced suite (2 species) DTA will be undertaken each year (i.e. twice in the first year and three times in subsequent years per calendar year). Chemical characterisation of PW samples will be undertaken coincident with each DTA (i.e. approximately quarterly). The DTA will be an early warning indicator, to show any changes in toxicity to support potential adaptive management actions to prevent any exceedance of EPO 7.1 or 7.2.

The sampling and analytical methodologies for DTA are often commercial-in-confidence documents of the various analytical laboratories (ANZG 2023), though general guidance on the requirements for undertaking effective DTA is available in publications such as Hall and Golding (1998) and Van Dam and Chapman (2001).

Key considerations for the collection of PW samples are:

- All samples should be collected from the nearest practicable sample location to the point of discharge.
- The volumes of PW to be collected for DTA will need to advised by the analytical laboratories and/or monitoring contractor/s.
- For DTA, bulk samples of seawater from the receiving environment are typically collected (for serial dilutions of PW within the analysing laboratory). However, given the remote offshore location and unmodified locations toxicants, this additional logistical complexity is not warranted. Of more importance will be the properties of the receiving water versus lab water, especially organic carbon concentrations.

DTA generates data on the toxicity of the PW upon the test species and, via serial dilutions in the laboratory, determines the extent to which the toxic effects of PW declines with decreasing PW concentrations.

Warne et al (2018) provide guidance in relation to the number and types of species selected for DTA and it is understood this guidance will soon be updated. In order to derive SSD it is expected that:

- The minimum acceptable amount of data is considered to be six species that belong to at least four different taxonomic groups. However, toxicity data for more species and more taxonomic groups is encouraged.
- Datasets that have 6–8 species are considered ‘adequate’.
- Datasets that contain data for 8–14 species that belong to at least four taxonomic groups are considered ‘good’
- Datasets that contain data for at least 15 species belonging to at least four taxonomic groups are termed ‘preferred’.

The number of species utilised within the DTA of the Prelude PW will depend upon the availability of species cultured by the analysing laboratory at the time of PW toxicity assessment, however for consistency every attempt will be made to utilise the same 11 species (where available) that were utilised for the previous DTA (WET) tests conducted. If the same species are not available, a core subset of at least six species will be used for all DTAs to support ready temporal comparisons of PW toxicity and ensure the derivation of robust SSD. It is noted that under the forthcoming 2025 revision of the ANZG technical guidance (Warne et al., 2025), SSDs based on fewer than six species will no longer be acceptable. Any SSDs will be developed in accordance with the updated ANZG technical guidance (Warne et al., 2025), using the most up-to-date statistical methods, and chronic data only.

Selection of species for quarterly 2 species DTA testing will consider taxonomic breadth (e.g., plants and animals) as well as different endpoints (growth, reproduction and development) to ensure the tests capture a range of different modes of action. CUSUM (cumulative sum) control charts for the selected indicator species will be established to detect deviations in toxicity trends and trigger adaptive management responses.

3.4 Mechanistic Modelling

While DTA testing provides an empirical measure of cumulative toxicity, mechanistic modelling offers diagnostic insight into the relative contributions of individual chemicals (Parkerton et al., 2018). Mechanistic models integrate measured PW concentrations with SSD-derived EC50 or LC50 values, assuming additivity, to estimate total toxicity expressed in toxic units (TU), where 1 TU represents a concentration equal to the EC50 (acute) or negligible effect concentration (chronic).

Mechanistic modelling was previously applied to Prelude PW (Brinkman et al., 2025) and found that modelled toxicity consistently underestimated DTA-derived toxicity by approximately 7-fold for acute and 2-fold for chronic exposures. This underestimation is likely due to incomplete chemical characterisation, the use of less sensitive species in SSDs, and the exclusion of potential synergistic effects. Despite these limitations, mechanistic modelling provides valuable insight into key toxicity drivers, supports prioritisation of monitoring and treatment targets, and allows cost-effective risk assessment based on routine chemical monitoring. Used in combination with DTA testing, this modelling approach can significantly enhance adaptive management of PW discharges, allowing for earlier detection of risk and more targeted mitigation strategies.

4 Sediment Monitoring

Limiting the changes to water quality (i.e. through the effective monitoring and management of the Prelude PW discharge), which is the pathway to impacts upon sediment quality, provides a high degree of confidence that no detectable environmental impacts will occur outside of the mixing zone boundary. Potential contaminants in the PW discharge could only be introduced into sediments around the facility through precipitations of soluble contaminants and flocculation and sedimentation of the particles in the PW plume. Conservatively, the impact zone for sediment is set at 700 m form the stern of Prelude, consistent with the PW EPSs. Sediment quality may be slightly impacted at locations immediately around the facility over a longer timeframe (e.g. tens of years) but is considered unlikely over duration this EP revision is in force.

Monitoring of seabed sediments will be undertaken at least once by 2030; it is currently being planned for 2026 aligned with Crux sediment monitoring. The physio-chemical parameters for which analyses will be undertaken will comprise those analytes with the potential to have been influenced by the PW discharge (i.e. a subset of the analytes listed in Table 4-1). The toxicant concentrations measured from the <2 mm sediment fraction of a sediment sample, where practicable, around the facility and reference sites will be compared with the sediment DGVs and GV-High.

Table 4-1 Sediment Analytes and Practical Quantitation Limits (PQLs)

Analyte	PQL
Moisture	1%
Particle Size Distribution (PSD)	<4 µ, 4-62 µ, 62-250 µ, 250-500 µ, 500-2000 µ, >2000 µ
Total Organic Carbon (TOC)	10-100 mg/kg
Total Metals	
Aluminium	50 mg/kg

Analyte	PQL
Arsenic	1 mg/kg
Barium	1 mg/kg
Cadmium	0.1 mg/kg
Chromium	1 mg/kg
Copper	1 mg/kg
Iron	50 mg/kg
Lead	1 mg/kg
Mercury	0.01 mg/kg
Nickel	1 mg/kg
Zinc	1 mg/kg
Hydrocarbons	
Total Recoverable Hydrocarbons (TRH)	3-5 mg/kg
Polycyclic Aromatic Hydrocarbons (PAHs, where TRHs detected)	0.004-0.005 mg/kg
Volatile hydrocarbons: Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene (BTEXN)	0.2 mg/kg
Heterocyclic Aromatic Compounds	Species dependent
Oil & Grease	100 mg/kg
Nutrients	
Total Nitrogen (TN)	20 mg/kg
Nitrite + Nitrate (NOx)	0.1 mg/kg
Total Kjeldahl Nitrogen (TKN)	20 mg/kg
Total Phosphorus (TP)	2 mg/kg
Radionuclides[3]	
Radium-226 (Ra-226)	
Radium-228 (Ra-228)	
Thorium-228 (Th-228)	
Potassium – 40 (K-40)	
Lead – 210 (Pb-210)	
Uranium-238 (U-238)	
Total alpha	500 Bq/L
Total beta	500 Bq/L

For quality assurance/quality control (QA/QC) purposes, consistent with ANZG field sampling and laboratory analysis, the following sediment samples will be required, in addition to the primary samples:

- Triplicate sediment samples (two additional samples at each site) at a minimum of 5% of the primary sampling sites), with one of the samples sent to a secondary analytical laboratory.
- Duplicate split sediment samples (one additional sample at each site) at a minimum of 10% of the primary sampling sites).

[3] Ongoing monitoring can default to gross alpha and beta and only trigger testing for individual radionuclides where elevations are detected.

The following water samples will also be required for QA/QC purposes:

- One trip blank sample of deionised water provided by the primary analytical laboratory. This will accompany the field sample containers throughout the survey and be analysed on arrival back at the laboratory to assess whether contamination has occurred from the sample containers or during sample transportation.
- One field blank sample effected by exposing laboratory-supplied deionised water to the atmosphere during sample collection. This will be used to identify and quantify any airborne contaminants present (e.g. exhaust emissions).
- One rinsate blank on each of the sampling days, to be effected by pouring laboratory-supplied deionised water over the sampling equipment after it has been decontaminated between sample sites and catching the rinse water in a glass jar for laboratory analysis.

Future sediment monitoring frequencies will be informed by the initial sediment monitoring campaign.

5 Adaptive Management

The PW discharge is managed through the adaptive management process, including defined triggers values/ events and resultant investigation and management response measures, to provide a mechanism to ensure the PW discharge is within limits and the PW treatment meets expected levels of performance (ALARP and acceptable).

The triggers and responses detailed in Table 5-1 are consistent with ANZG (2018; 2023) guidance and NOPSEMA expectations. They are designed to provide early warning and escalation pathways for managing potential exceedances of mercury and other contaminants in sediment and water quality. Each trigger activates a corresponding adaptive management action, forming a tiered response that escalates controls based on risk severity and environmental uncertainty to ensure respective EPO's and EPS's are achieved or returned to compliance as soon as reasonably practicable following an exceedance.

Table 5-1 Adaptive management triggers and response measures

	Parameter / Monitoring	Trigger Values / Events	Actions and/or adaptive management measures
1	TPH	OIW concentration exceeds 20 mg/L based on a 24-hour rolling average.	PW will only be discharged to the marine environment if the OIW concentration is less than 20 mg/L (24-hour average). Alarms are in place to automatically divert the PW inboard If OIW exceeds 20 mg/L (24-hour average).
		Loss of OIW online analyser signal (e.g. maintenance).	On loss of the on-line analyser the onboard manual laboratory measurements for TPH concentration are taken approximately every 12 hours to ensure the requirement for TPH concentration of less than 20 mg/L over a 24-hour period can be verified.
		12 monthly reviews of TPH data following the introduction of Crux gas.	Annually assess if a reduced operational target for the following 12 months can be implemented.
2	Density and Flow	A greater than 25% increase in PW density is observed. Average discharge rates exceed 155 m^3/hr over one month.	Undertake re-modelling of the PW discharge based on new rates and/or density. Modelling is initiated with one month of being triggered.
3	Mercury	Mercury is identified above the 0.5 µg/L detection limit at the inlet to the MPPE.	Sample is taken at the MPPE outlet, at the next available discharge opportunity, to determine the mercury concentration in the overboard discharge.
		Mercury concentration in the overboard discharge is above 1 µg/L during Prelude only production.	1 PW is immediately diverted inboard to the PW Buffer Tank. 2 Investigate the potential cause of the mercury increase and adopt available ALARP measures to reduce mercury concentration, as soon as practicable.
		Mercury concentration in the overboard discharge is above 6.5 µg/L following the introduction of Crux gas.	1 PW is immediately diverted inboard to the PW Buffer Tank. 2 Investigate the potential cause of the mercury increase, and identify and adopt available ALARP measures to reduce mercury concentration, as soon as practicable.
		12 monthly reviews of mercury data following the introduction of Crux gas.	Annually assess if a reduced operational target for the following 12 months can be implemented.
4	Chemical Characterisation	Concentrations of potential contaminants in PW exceed previous results by an average of >25% over 2 consecutive samples, or previously undetected contaminates are identified.	1 Undertake mechanistic modelling to inform if there is potential for increased toxicity and a risk of EPO/EPS exceedance. Modelling is initiated with 2 weeks of being triggered. 2 Investigate chemical characterisation results, mechanistic modelling results and operational data, as relevant, and adopt ALARP measures to reduce PW toxicity, as soon as practicable (e.g. adjust chemical dosing, change chemical selection and process optimisation).

	Parameter / Monitoring	Trigger Values / Events	Actions and/or adaptive management measures
			3 If mechanistic modelling indicates increased risk of toxicity, the next quarterly DTA test undertaken is a full suite test to determine if EPOs/EPSs are being met.
5	2 species DTA testing	Results show established control limits have been exceeded.	1 Undertake mechanistic modelling to inform if there is potential for increased toxicity and a risk of EPO/EPS exceedance. Modelling is initiated with 2 weeks of being triggered. 2 Investigate chemical characterisation results, mechanistic modelling results and operational data, as relevant, and adopt ALARP measures to reduce PW toxicity, as soon as practicable (e.g. adjust chemical dosing, change chemical selection and process optimisation). 3 If subsequent 2spp. DTA is also outside control limits, undertake full suite DTA with mechanistic modelling to determine if EPOs/EPSs are being met.
6	Full suite (11 species) DTA testing	Results indicate that PW toxicity is predicted to exceed: • 80% of the PC99 ≥ 700 m from the stern of Prelude • 80% of the PC95 ≥ 200 m from the stern of Prelude	1 Undertake mechanistic modelling to inform if there is potential for increased toxicity and a risk of EPO/EPS exceedance. Modelling is initiated with 2 weeks of being triggered. 2 Investigate chemical characterisation results, mechanistic modelling results and operational data, as relevant, and adopt ALARP measures to reduce PW toxicity, as soon as practicable (e.g. adjust chemical dosing, change chemical selection and process optimisation). 3 Next 2spp. DTA do full suite DTA instead, together with mechanistic modelling to determine if EPOs/EPSs are being met.
7	Sediment Monitoring	Field sampling indicates an increase in contaminant levels to above 80% of SQ GVs ≥ 700 m from the stern of Prelude that are attributable to PW discharges, except where pre-operations baseline monitoring potentially shoe exceedance already.	1 Investigate the cause of the increased contaminant concentration and as relevant, adopt ALARP measures to reduce the concentration of the contaminant, as soon as practicable (e.g. adjust chemical dosing, change chemical selection and process optimisation). 2 If risk assessment identifies risk of EPO non-compliance, increase frequency of sediment monitoring to annual for remainder of EP being in-force.

6 Implementation Strategy

The intent of the implementation strategy is to ensure that the agreed management strategies, including all monitoring, trigger responses, and escalation pathways referenced are effectively implemented and embedded into day-to-day operations. This step focuses on translating the adaptive management framework into operational practice, consistent with the ANZG WQMF emphasis on continuous improvement and the EP's Section 10 commitments to performance management, monitoring, and reporting.

Key implementation elements include:

- Operationalisation of Monitoring and Triggers: All monitoring activities (e.g. DTA, chemical characterisation, and sediment sampling) and trigger thresholds are integrated into the facility's management system ensuring timely detection and response to environmental risks.
- Execution of Adaptive Management Actions: Triggered actions (as defined in Table 5-1) are implemented through established systems such as the Compliant and We Can Prove It (CAWPI) system.
- Data Management and Reporting: Environmental data are captured, quality-assured, and stored in accordance with Shell's internal systems and regulatory requirements. Results are reviewed regularly to assess compliance with Environmental Performance Objectives (EPOs) and inform internal and external reporting obligations.
- Performance Review and Feedback Loops: Outcomes from monitoring and management actions are reviewed periodically, as appropriate, to assess effectiveness, identify trends, and inform updates to the AMMF and EP. This includes formal reviews aligned with the EP revision cycle and informal reviews triggered by monitoring results or operational changes.

This implementation strategy ensures that the AMMF is not only a planning tool but a living framework embedded in Prelude operations, enabling Shell to manage environmental risks from produced water discharge in a responsive, transparent, and accountable manner.

7 References

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