WA-49-L Gemtree Anchor Hold Testing Environment Plan

December 2019
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1 INTRODUCTION

1.1 Overview

Woodside Energy Julimar Pty Ltd (Woodside), as Titleholder, under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (referred to as the Environment Regulations), proposes to undertake anchor hold testing within permit area WA-49-L for the proposed Gemtree-A exploration well; hereafter referred to as the Petroleum Activities Program and forms the scope of this Environment Plan (EP). The anchor test is being conducted to ensure mooring capability for a mobile offshore drilling unit (MODU) proposed to be used for exploration drilling in the permit area.

This EP has been prepared as part of the requirements under Environment Regulations, as administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

1.2 Defining the Petroleum Activity

The Petroleum Activities Program to be undertaken in Permit Area WA-49-L comprises anchor hold testing, which is a petroleum activity as defined in Regulation 4 of the Environment Regulations. As such an EP is required.

1.3 Purpose of the Environment Plan

In accordance with the objectives of the Environment Regulations, the purpose of this EP is to demonstrate that:

- the potential environmental impacts and risks (planned (routine and non-routine) and unplanned) that may result from the Petroleum Activities Program are identified
- appropriate management controls are implemented to reduce impacts and risks to a level that is ‘as low as reasonably practicable’ (ALARP) and acceptable
- the Petroleum Activities Program is carried out in a manner consistent with the principles of ecologically sustainable development (as defined in Section 3A of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act]).

This EP describes the process and resulting outputs of the risk assessment, whereby impacts and risks are managed accordingly.

The EP defines activity-specific environmental performance outcomes, standards, and measurement criteria. These form the basis for monitoring, auditing, and managing the Petroleum Activities Program to be undertaken by Woodside and its contractors. The implementation strategy (derived from the decision support framework tools) specified in this EP provides Woodside and NOPSEMA with the required level of assurance that impacts, and risks associated with the activity are reduced to ALARP and are acceptable.

1.4 Scope of the Environment Plan

The scope of this EP covers anchor hold testing around the exploration drill location within permit area WA-49-L.

The Petroleum Activities Program is described in Section 3.

1.5 Environment Plan Summary

An EP summary will be prepared based on the material provided in this EP. Table 1-1 summarises the content that will be provided within the EP summary, as required by Regulation 11(4).

Table 1-1: EP summary

EP Summary material requirement	Relevant section of this EP containing EP Summary material
The location of the activity	Section 3.2, pages 35–37
A description of the receiving environment	Section 4, pages 40–118
A description of the activity	Section 3, pages 35–39
Details of the environmental impacts and risks	Section 6, pages 128–196
The control measures for the activity	Section 6, pages 128–196
The arrangements for ongoing monitoring of the titleholder's environmental performance	Section 7.5, pages 199–203
Response arrangements in the oil pollution emergency plan	Section 7.9, pages 208–211, and Appendix D
Consultation already undertaken and plans for ongoing consultation	Section 5, pages 119–128
Details of the titleholder's nominated liaison person for the activity	Section 1.8, page 16

1.6 Structure of the Environment Plan

The EP has been structured to reflect the process and requirements of the Environment Regulations, as outlined in Table 1-2.

Table 1-2: EP process phases, applicable regulations and relevant section of EP

Criteria for acceptance	Content Requirements/Relevant Regulations	Elements	Section of EP
Regulation 10A(a): is appropriate for the nature and scale of the activity	Regulation 13: Environmental Assessment Regulation 14: Implementation strategy for the environment plan Regulation 16: Other information in the environment plan	The principle of 'nature and scale' applies throughout the EP	Section 2 Section 3 Section 4 Section 5 Section 6 Section 7
Regulation 10A(b): demonstrates that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable Regulation 10A(c): demonstrates that the environmental impacts and risks of the activity will be of an acceptable level	Regulation 13(1)–13(7): 13(1) Description of the activity 13(2)(3) Description of the environment 13(4) Requirements 13(5)(6) Evaluation of environmental impacts and risks 13(7) Environmental performance outcomes and standards Regulation 16(a)–16(c): A statement of the titleholder's corporate environmental policy A report on all consultations between the titleholder and any relevant person	Set the context (activity and existing environment) Define 'acceptable' (the requirements, the corporate policy, relevant persons) Detail the impacts and risks Evaluate the nature and scale Detail the control measures – ALARP and acceptable	Section 1 Section 2 Section 3 Section 4 Section 5 Section 6 Section 7
Regulation 10A(d): provides for appropriate environmental performance outcomes, environmental	Regulation 13(7): Environmental performance outcomes and standards	Environmental Performance Objectives (EPOs) Environmental Performance Standards (EPSs) Measurement Criteria (MC)	Section 6

Criteria for acceptance	Content Requirements/Relevant Regulations	Elements	Section of EP
performance standards and measurement criteria			
Regulation 10A(e): includes an appropriate implementation strategy and monitoring, recording and reporting arrangements	Regulation 14: Implementation strategy for the environment plan	Implementation strategy, including: • systems, practices and procedures • performance monitoring • Oil Pollution Emergency Plan (OPEP) and scientific monitoring • ongoing consultation.	Section 7 Appendix D
Regulation 10A(f): 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 within the meaning of the EPBC Act	Regulation 13 (1)–13(3): 13(1) Description of the activity 13(2) Description of the environment 13(3) Without limiting [Regulation 13(2)(b)], particular relevant values and sensitivities may include any of the following: (a) the world heritage values of a declared World Heritage property within the meaning of the EPBC Act; (b) the national heritage values of a National Heritage place within the meaning of that Act; (c) the ecological character of a declared Ramsar wetland within the meaning of that Act; (d) the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act; (e) the presence of a listed migratory species within the meaning of that Act; (f) any values and sensitivities that exist in, or in relation to, part or all of: (i) a Commonwealth marine area within the meaning of that Act; or (ii) Commonwealth land within the meaning of that Act.	No activity, or part of the activity, undertaken in any part of a declared World Heritage property	Section 3 Section 4 Section 6
Regulation 10A(g): (i) the titleholder has carried out the consultations required by Division 2.2A (ii) the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate	Regulation 11A: Consultation with relevant authorities, persons and organisations, etc. Regulation 16(b): A report on all consultations between the titleholder and any relevant person	Consultation in preparation of the EP	Section 5

Criteria for acceptance	Content Requirements/Relevant Regulations	Elements	Section of EP
Regulation 10A(h): complies with the Act and the regulations	Regulation 15: Details of the Titleholder and liaison person Regulation 16(c): Details of all reportable incidents in relation to the proposed activity.	All contents of the EP must comply with the Act and the regulations	Section 1.6 Section 7.7

1.7 Description of the Titleholder

The nominated Titleholder for this activity is Woodside Energy Julimar Pty Ltd, on behalf of a Joint Venture comprising Woodside Energy Julimar Pty Ltd and KUFPEC Australia (Julimar) Pty Ltd.

Woodside's mission is to deliver superior shareholder returns through realising its vision of becoming a global leader in upstream oil and gas. Wherever Woodside works, it is committed to living its values of integrity, respect, working sustainably, discipline, excellence, and working together.

Woodside's operations are characterised by strong safety and environmental performance in remote and challenging locations.

Through collaboration, Woodside leverages its capabilities to progress its growth strategy. Since 1984, the company has been operating the landmark Australian project, the North West Shelf (NWS), which is one of the world's premier liquefied natural gas (LNG) facilities. In 2012, Woodside added the Pluto LNG Plant to its onshore operating facilities.

Woodside has an excellent track record of efficient and safe production. Woodside strives for excellence in safety and environmental performance and continues to strengthen relationships with customers, partners, co-venturers, governments, and communities to ensure they are a partner of choice. Further information about Woodside can be found at http://www.woodside.com.au.

1.8 Details of Titleholder, Liaison Person and Public Affairs Contact

In accordance with Regulation 15 of the Environment Regulations, details of the titleholder, liaison person and arrangements for the notification of changes are described below.

1.8.1 Titleholder

Woodside Energy Julimar Pty Ltd

11 Mount Street

Perth, Western Australia

T: 08 9348 4000

ACN: 63 005 482 986

1.8.2 Activity Contact

Terrence Folkers

Exploration Manager – Pluto Growth Team

11 Mount Street

Perth, Western Australia

T: 08 9348 4000

1.8.3 Nominated Liaison Person

Daniel Cleary

Corporate Affairs Manager

11 Mount Street

Perth, Western Australia

T: 08 9348 4000

E: feedback@woodside.com.au

1.8.4 Arrangements for Notifying Change

If the titleholder, titleholder's nominated liaison person, or the contact details for the titleholder or the liaison person change, then NOPSEMA will be notified of the change in writing within two weeks or as soon as practicable.

1.9 Woodside Management System

The Woodside Management System (WMS) provides a structured framework of documentation to set common expectations governing how all employees and contractors at Woodside will work. Many of the standards presented in Section 6 are drawn from the WMS documentation, which comprises four elements: Compass and Policies; Expectations; Processes and Procedures; and Guidelines, as outlined below (and illustrated in Figure 1-1).

- **Compass and Policies**: Set the enterprise-wide direction for Woodside by governing our behaviours, actions, and business decisions and ensuring we meet our legal and other external obligations.
- **Expectations**: Set essential activities or deliverables required to achieve the objectives of the Key Business Activities and provide the basis for developing processes and procedures.
- **Processes and Procedures**: Processes identify the set of interrelated or interacting activities that transforms inputs into outputs, to systematically achieve a purpose or specific objective. Procedures specify what steps, by whom, and when required to carry out an activity or a process.
- **Guidelines**: Provide recommended practice and advice on how to perform the steps defined in Procedures, together with supporting information and associated tools. Guidelines provide advice on: how activities or tasks may be performed; information that may be taken into consideration; or, how to use tools and systems.

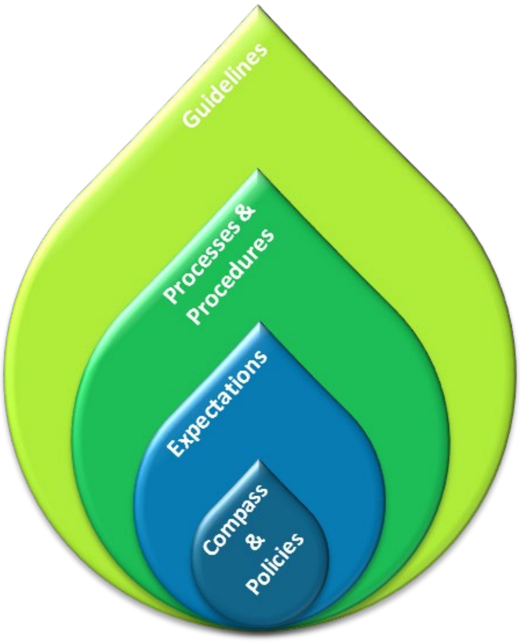


Figure 1-1: The four major elements of the WMS Seed

The WMS is organised within a Business Process Hierarchy based upon Key Business Activities to ensure the system remains independent of organisation structure, is globally applicable and scalable wherever required. These Key Business Activities are grouped into Management, Support, and Value Stream activities as shown in Figure 1-2. The Value Stream activities capture, generate and deliver value through the exploration and production lifecycle. The Management activities influence all areas of the business, while Support activities may influence one or more value stream activities.

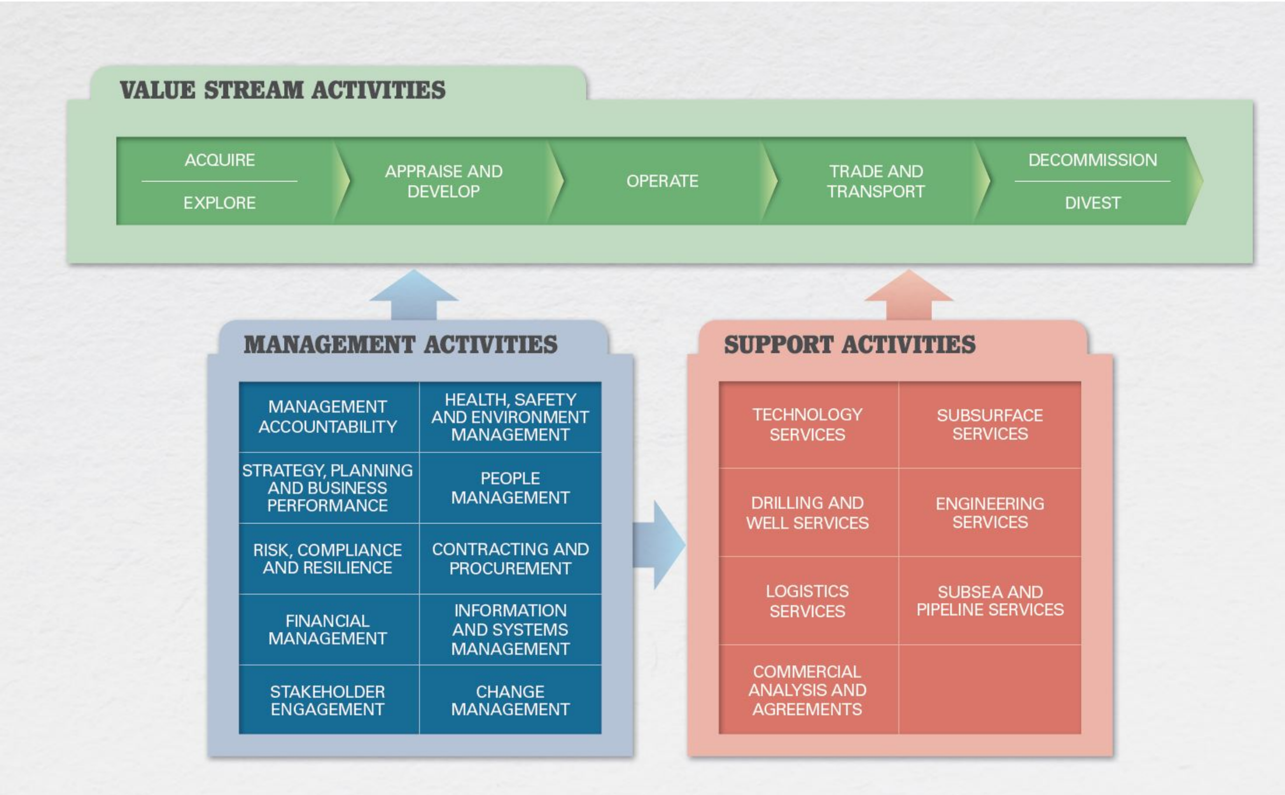


Figure 1-2: The WMS business process hierarchy

In accordance with Regulation 16(a) of the Environment Regulations, Woodside's Corporate Health, Safety, Environment and Quality Policy is provided in Appendix A of this EP.

1.10 Description of Relevant Requirements

In accordance with Regulation 13(4) of the Environment Regulations, a description of requirements, including legislative requirements, that apply to the activity and are relevant to the management of risks and impacts of the Petroleum Activities Program are detailed in Appendix B. This EP will not be assessed under the WA *Environmental Protection Act 1986* as the activity does not occur on State land or within State Waters.

1.10.1 Applicable Environmental Legislation

The Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) controls exploration and production activities beyond three nautical miles (nm) of the mainland (and islands) to the outer extent of the Australian Exclusive Economic Zone (EEZ) at 200 nm.

The Environment Regulations apply to petroleum activities in Commonwealth Waters, and are administered by NOPSEMA.

The objective of the Environment Regulations is to ensure petroleum activities are performed in a manner:

- consistent with the principles of ecological sustainable development set out in section 3A of the EPBC Act
- by which the environmental impacts and risks of the activity will be reduced to ALARP
- by which the environmental impacts and risks of the activity will be of an acceptable level.

1.10.1.1 Australian Marine Parks

Under the EPBC Act, Australian Marine Parks (AMPs), formally known as Commonwealth Marine Reserves, are recognised for conserving marine habitats and the species that live and rely on these habitats. The Director of National Parks (DNP) is responsible for managing AMPs (supported by Parks Australia), and is required to publish management plans for them. Other parts of the Commonwealth Government must not perform functions or exercise powers in relation to these parks that are inconsistent with management plans (s.362 of the EPBC Act). Relevant AMPs are described in Section 4.7. The North-west Marine Parks Network Management Plan describes the requirements for management.

Specific zones within the AMPs have been allocated conservation objectives as stated below (International Union for Conservation of Nature [IUCN] Protected Area Category) based on the Australian IUCN reserve management principles outlined in Schedule 8 of the EPBC Regulations 2000:

- Special Purpose Zone (IUCN category VI): managed to allow specific activities through special purpose management arrangements while conserving ecosystems, habitats and native species. The zone allows or prohibits specific activities.
- Sanctuary Zone (IUCN category Ia): managed to conserve ecosystems, habitats and native species in as natural and undisturbed a state as possible. The zone allows only authorised scientific research and monitoring.
- National Park Zone (IUCN category II): managed to protect and conserve ecosystems, habitats and native species in as natural a state as possible. The zone only allows non-extractive activities unless authorised for research and monitoring.

- Recreational Use Zone (IUCN category IV): managed to allow recreational use, while conserving ecosystems, habitats and native species in as natural a state as possible. The zone allows for recreational fishing, but not commercial fishing.
- Habitat Protection Zone (IUCN category IV): managed to allow activities that do not harm or cause destruction to seafloor habitats, while conserving ecosystems, habitats and native species in as natural a state as possible.
- Multiple Use Zone (IUCN category VI): managed to allow ecologically sustainable use while conserving ecosystems, habitats and native species. The zone allows for a range of sustainable uses, including commercial fishing and mining where they are consistent with park values

2 ENVIRONMENT PLAN PROCESS

2.1 Overview

This section outlines the process that Woodside follows to prepare an EP once an activity has been defined as a petroleum activity (refer Section 1.2). The process (Section 2.3) describes the environmental risk management methodology that is used to identify, analyse and evaluate risks to meet ALARP and acceptability requirements and develop environmental performance outcomes and standards. This section also describes Woodside's risk management methodologies applicable to implementation strategies applied during the activity.

Regulation 13(5) of the Environment Regulations requires environmental impacts and risks to be detailed, and evaluated appropriate to the nature and scale of each impact and risk associated with the Petroleum Activities Program. The objective of the risk assessment process described in this section is to identify risks and associated impacts of an activity, so they can be assessed and appropriate control measures applied to eliminate, control or mitigate the impact/risk to ALARP and to determine if the impact or risk level is acceptable.

Environmental impacts and risks include those directly and indirectly associated with the Petroleum Activities Program, and includes potential emergency and accidental events:

- planned activities have the potential for inherent environmental impacts
- an environmental risk is an unplanned event with the potential for impact (termed risk 'consequence').

Herein, potential impact from planned activities are termed 'impacts', and 'risks' are associated with unplanned events with the potential for impact (should the risk be realised), with such impact termed potential 'consequence'.

2.2 Environmental Risk Management Methodology

2.2.1 Woodside Risk Management Processes

Woodside recognises that risk is inherent to its business and effectively managing those risks is vital to delivering on company objectives, success and continued growth. Woodside is committed to managing all risks proactively and effectively. The objective of Woodside's risk management system is to provide a consistent process for recognising and managing risks across Woodside's business. Achieving this objective includes ensuring risks consider impacts across the following key areas of exposure: health and safety, environment, finance, reputation and brand, legal and compliance, and social and cultural. A copy of Woodside's Risk Management Policy is provided in Appendix A.

The environmental risk management methodology used in this EP is based on Woodside's Risk Management Procedure. This procedure aligns to industry standards such as international standard organisation (ISO) 31000:2009. The WMS risk management procedures, guidelines and tools provide guidance on specific techniques for managing risk, these tailor the Risk Management Procedure for particular areas of risk within certain business processes. Three such procedures applied for managing environmental risk include Woodside's:

- Health Safety and Environment Management Procedure
- Impact Assessment Procedure
- Process Safety Management Procedure.

The risk management methodology provides a framework to demonstrate that the identified risks and impacts are continually identified, reduced to ALARP and assessed to be at an acceptable level, as required by the Environment Regulations. The key steps of Woodside's Risk Management

Process are shown in Figure 2-1. A description of each step and how it is applied to the scopes of this activity is provided in Sections 2.1 to Section 2.10.

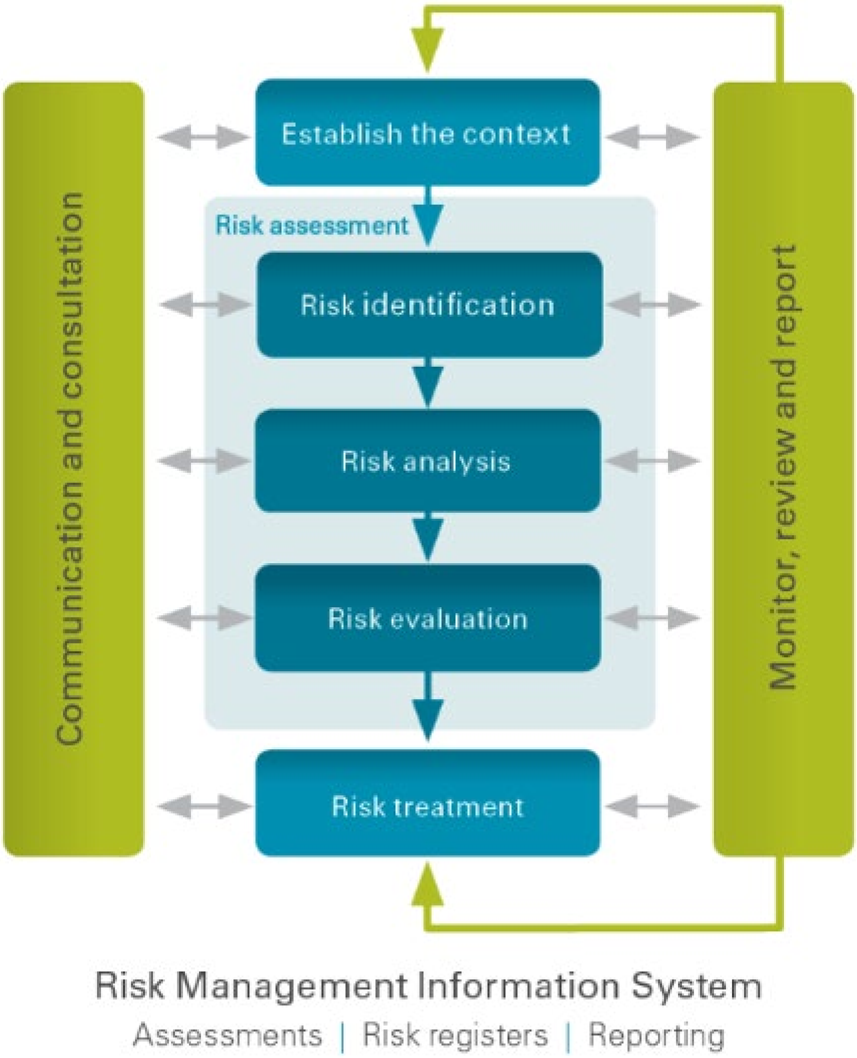


Figure 2-1: Woodside's risk management process

2.2.2 Health, Safety and Environment Management Procedure

Woodside's Health, Safety and Environment Management Procedure provides a structure for managing health, safety and environment (HSE) risks and impacts across Woodside and defines the decision-making authorities for company-wide HSE management activities and deliverables, and to support continuous improvement in HSE management.

2.2.3 Impact Assessment Procedure

To support effective environmental risk assessment, Woodside's Impact Assessment Procedure (Figure 2-2) provides the steps needed to meet required environment, health and social standards through ensuring impact assessments are appropriate to the nature and scale of the activity, the regulatory context, the receiving environment, interests, concerns and rights of stakeholders, and the applicable framework of standards and practices.

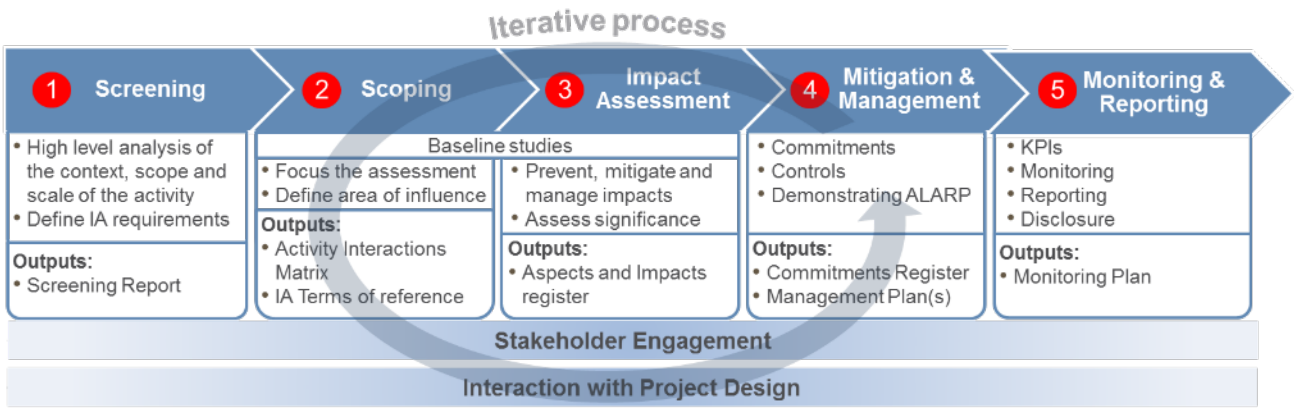


Figure 2-2: Woodside's impact assessment process

2.3 Environment Plan Process

Figure 2-3 illustrates the Environment Plan development process. Each element of this process is discussed in Sections 2.4 to Section 2.10.

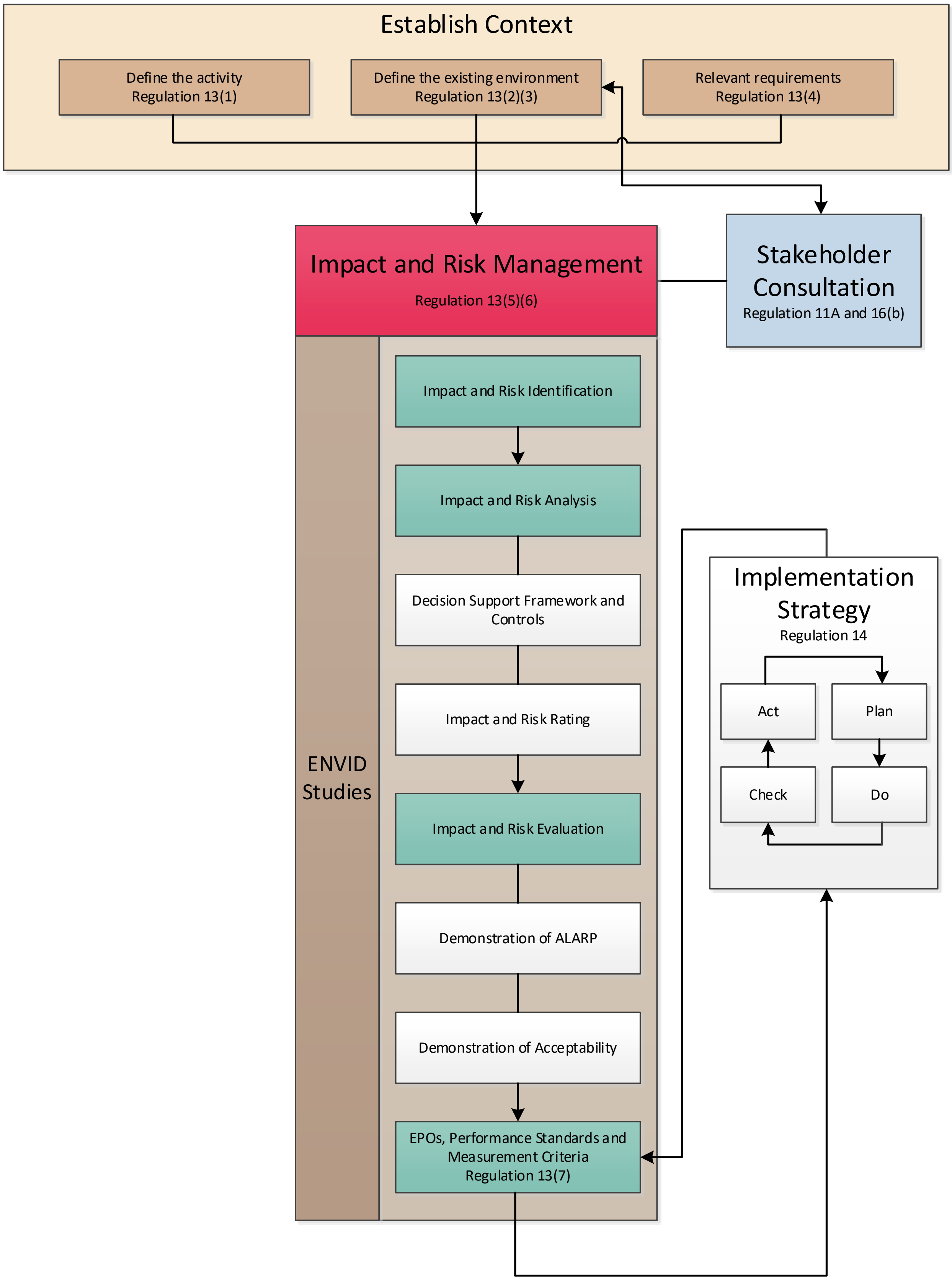


Figure 2-3: Environment plan development process

2.4 Establish the Context

2.4.1 Define the Activity

This first stage involves evaluating whether the activity meets the definition of a 'petroleum activity' as defined in the Environment Regulations.

The activity is then described in relation to:

- the location
- what is to be undertaken
- how it is planned to be undertaken, including outlining operational details of the activity and proposed timeframes.

The 'what' and 'how' are described in the context of 'environmental aspects'[1] to inform the risk and impact assessment for planned (routine and non-routine) and unplanned (accidents/incidents/emergency conditions) activities.

The activity is described in Section 3 and referred to as the Petroleum Activities Program.

2.4.2 Define the Existing Environment

The existing environment that may be impacted by the Petroleum Activities Program (as described in Section 4) is defined by considering the nature and scale of the activities (i.e. size, type, timing, duration, complexity and intensity). The existing environment may potentially be impacted directly or indirectly by planned and unplanned[2] events. The existing environment (Section 4) is structured into sub-sections defining the physical, biological, socio-economic and cultural attributes of the area of interest in accordance with the definition of 'environment' in Regulation 4(a) of the Environment Regulations. These sub-sections make particular reference to the following:

- The environmental values potentially impacted by the Petroleum Activities Program, which include key physical and biological attributes of the existing environment (as defined by Woodside in Table 2-1 and Section 2.4.2).
- EPBC Act matters of national environmental significance (MNES) including listed threatened species and ecological communities, and listed migratory species. Defining the spatial extent of the existing environment is guided by the nature and scale of the Petroleum Activities Program within the Operational Area (planned activities) and the environment that may be affected (EMBA) by unplanned events. Potential impacts to MNES as defined within the EPBC Act are addressed through Woodside's impact and risk assessment process (Section 2.6).
- Relevant values and sensitivities, which may include world or national heritage listed areas, Ramsar wetlands, listed threatened species or ecological communities, listed migratory species, sensitive values that exist in, or in relation to commonwealth marine area or land.
- In categorising the environmental values potentially impacted by the Petroleum Activities Program (as presented in Table 2-1), information is standardised relevant to the understanding of the receiving environment. Potential impacts to these environmental

[1] An environmental aspect is an element of the activity that can interact with the environment.

[2] The worst-case unplanned event is considered to be an unplanned hydrocarbon release, further defined for each activity through the risk assessment process. Interpretation of stochastic oil spill modelling determines the EMBA for the release, which defines the spatial scale of the environment that may be potentially impacted by the Petroleum Activities Program, which provides context to the 'nature and scale' of the existing environment.

values are evaluated in the risk analysis (refer Section 2.6), and risk-rated for all planned and unplanned activities. This provides a robust approach to the overall environmental risk evaluation and its documentation in the EP.

Table 2-1: Example of the environment values potentially impacted which are assessed within the EP

Environmental Value Potentially Impacted *Regulations 13(2)(3)*						
Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl odour)	Ecosystems/Habitats	Species	Socio-Economic

The existing environment is described in Section 4.

2.4.3 Relevant Requirements

The relevant requirements in the context of legislation, other environmental approval requirements, conditions and standards that apply to the Petroleum Activities Program are identified and reviewed.

Relevant requirements are presented in Appendix B.

Woodside's corporate Heath Safety, Environment and Quality Policy is presented in Appendix A.

2.5 Impact and Risk Identification

Relevant environmental aspects and hazards have been identified to support the process to define environmental impacts and risks associated with an activity.

The environmental impact and risk assessment presented in this EP has been informed by recent and historic hazard identification studies (e.g. Hazard Identification (HAZID)/ Environmental Hazard Identification (ENVID)), process safety risk assessment processes, reviews and associated desktop studies associated with the Petroleum Activities Program. Risks are identified based on planned and potential interaction with the activity (based on the description in Section 3), the existing environment (Section 4) and the outcomes of Woodside's stakeholder engagement process (Section 5). The environmental outputs of applicable risk and impact workshops and associated studies are referred to as ENVID thereafter in this EP.

The ENVID has been undertaken by multidisciplinary teams consisting of relevant engineering and environmental personnel with sufficient breadth of knowledge, training and experience to reasonably assure that risks were identified and their potential environmental impacts assessed. Impacts and risks were identified during the ENVID for both planned (routine and non-routine) activities and unplanned (accidents/incidents/emergency conditions) events. During this process, risks that are identified as not applicable (not credible) are removed from the assessment. This is performed by defining the activity and identifying that an aspect is not applicable.

The impact and risk information is classified, evaluated and tabulated for each planned activity and unplanned event. Environmental impacts and risk are recorded in an environmental impacts and risk register. The output of the ENVID is used to present the risk assessment and forms the basis to develop performance outcomes, standards and measurement criteria. This information is presented in Section 6, using the format presented in Table 2-2.

Table 2-2: Example of layout of identification of risks and impacts in relation to risk sources

Impacts and Risks Evaluation Summary													
Source of Risk	***Environmental Value Potentially Impacted***							***Evaluation***					
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (incl Odour)	Ecosystems/Habitat	Species	Socio-Economic	Decision Type	Consequence/Impact	Likelihood	Risk Rating	ALARP Tools	Acceptability
Summary of source of impact/risk													

2.6 Impact and Risk Analysis

Risk analysis further develops the understanding of a risk by defining the impacts and assessing appropriate controls. Risk analysis considered previous risk assessments for similar activities, reviews of relevant studies, reviews of past performance, external stakeholder consultation feedback and review of the existing environment.

The key steps undertaken for each risk identified during the risk analysis were:

- identify the decision type in accordance with the decision support framework
- identify appropriate control measures (preventative and mitigative) aligned with the decision type
- assess the risk rating.

2.6.1 Decision Support Framework

To support the risk assessment process, and Woodside's determination of acceptability (Section 2.7.2), Woodside's HSE risk management procedures include using a decision support framework based on principles set out in the Guidance on Risk Related Decision Making (Oil and Gas UK, 2014). This concept has been applied during the ENVID, or equivalent preceding processes during historical design decisions, to determine the level of supporting evidence that may be required to draw sound conclusions about risk level and whether the risk is acceptable and ALARP (Table 2-4). This is to confirm:

- Activities do not pose an unacceptable environmental risk.
- Appropriate focus is placed on activities where the risk is anticipated to be acceptable and demonstrated to be ALARP.
- Appropriate effort is applied to managing risks based on the uncertainty of the risk, the complexity and risk rating (i.e. potential higher order environmental impacts are subject to further assessment).

The framework provides appropriate tools, commensurate to the level of uncertainty or novelty associated with the risk (referred to as Decision Type A, B or C). The decision type is selected based on an informed discussion around the uncertainty of the risk, and documented in ENVID output.

This framework enables Woodside to appropriately understand a risk, determine if the risk is acceptable and can be demonstrated to be ALARP.

2.6.1.1 Decision Type A

Risks classified as a Decision Type A are well understood and established practice. They generally consider recognised good industry practice, which is often embodied in legislation, codes and standards and use professional judgement.

2.6.1.2 Decision Type B

Risks classified as Decision Type B typically involve greater uncertainty and complexity (and can include potential higher order impacts/risks). These risks may deviate from established practice or have some lifecycle implications, and therefore require further engineering risk assessment to support the decision and ensure the risk is ALARP. Engineering risk assessment tools may include:

- risk-based tools such as cost based analysis or modelling
- consequence modelling
- reliability analysis
- company values.

2.6.1.3 Decision Type C

Risks classified as Decision Type C typically have significant risks related to environmental performance. Such risks typically involve greater complexity and uncertainty, therefore requiring a precautionary approach. The risks may result in significant environmental impact, significant project risk/exposure or may elicit negative stakeholder concerns. For these risks, in addition to Decision Type A and B tools, company and societal values need to be considered by undertaking broader internal and external stakeholder consultation as part of the risk assessment process.

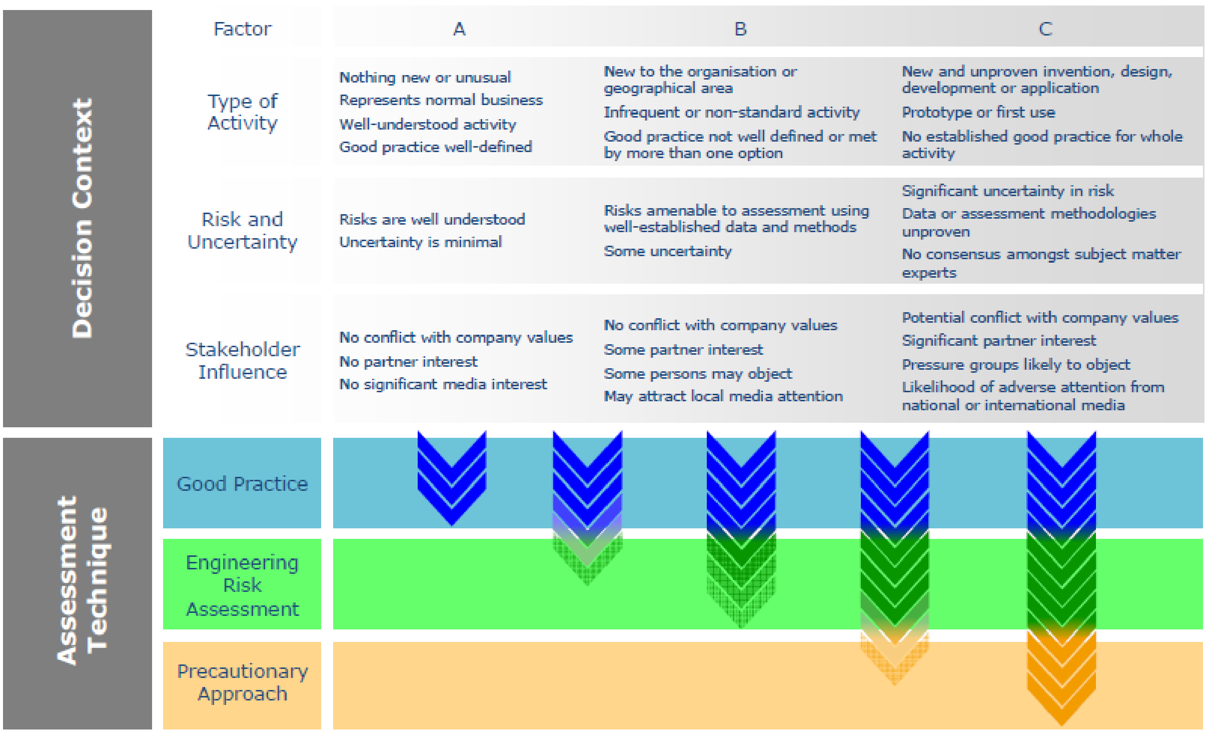


Figure 2-4: Risk related decision-making framework (Oil and Gas UK, 2014)

2.6.1.4 Decision Support Framework Tools

The following framework tools are applied, as appropriate, to assist with identifying control measures based on the decision type described above:

- **Legislation, Codes and Standards (LCS)** identifies the requirements of legislation, codes and standards which are to be complied with for the activity.
- **Good Industry Practice (GP)** identifies further engineering control standards and guidelines which may be applied by Woodside above those required to meet the legislation, codes and standards.
- **Professional Judgement (PJ)** uses relevant personnel with the knowledge and experience to identify alternative controls. Woodside applies the hierarchy of control as part of the risk assessment to identify any alternative measures to control the risk.
- **Risk Based Analysis (RBA)** assesses the results of probabilistic analyses such as modelling, quantitative risk assessment and/or cost benefit- analysis to support the selection of control measures identified during the risk assessment process.
- **Company Values (CV)** identifies values detailed in Woodside's code of conduct, policies and the Woodside compass. Views, concerns and perceptions are to be considered from internal Woodside stakeholders directly affected by the planned impact or potential risk.
- **Societal Values (SV)** identifies the views, concerns and perceptions of relevant stakeholders and addresses relevant stakeholder views, concerns and perceptions.

2.6.1.5 Decision Calibration

To determine that the selected alternatives and control measures applied are suitable, the following tools may be used for calibration (i.e. checking) where required:

- **Legislation, Codes and Standards/Verification of Predictions –** Verification of compliance with applicable legislation, codes and standards and/or good industry practice.
- **Peer Review –** Independent peer review of professional judgements, supported by risk based analysis, where appropriate.
- **Benchmarking** – Where appropriate, benchmarking against a similar facility or activity type or situation which has been accepted to represent acceptable risk.
- **Internal Stakeholder Consultation** – Consultation undertaken within Woodside to inform the decision and verify company values are met.
- **External Stakeholder Consultation** – Consultation undertaken to inform the decision and verify societal values are considered.

Where appropriate, additional calibration tools may be selected specific to the decision type and the activity.

2.6.2 Control Measures (Hierarchy of Controls)

Risk reduction measures should be prioritised and categorised in accordance with the hierarchy of controls, where risk reduction measures at the top of the hierarchy take precedence over risk reduction measures further down:

- **Elimination** of the risk by removing the hazard.
- **Substitution** of a hazard with a less hazardous one.

- **Engineering Controls** which include design measures to prevent or reduce the frequency of the risk event, detect or control the risk event (limiting the magnitude, intensity and duration) such as:
  - prevention: design measures that reduce the likelihood of a hazardous event occurring
  - detection: design measures that facilitate early detection of a hazardous event
  - control: design measures that limit the extent/escalation potential of a hazardous event
  - mitigation: design measures that protect the environment should a hazardous event occur
  - response equipment: design measures or safeguards that enable clean-up/response after a hazardous event occurs.
- **Procedures and Administration** which include management systems and work instructions used to prevent or mitigate environmental exposure to hazards.
- **Emergency Response and Contingency Planning** which includes methods to enable recovery from the impact of an event (e.g. protection barriers deployed near the sensitive receptor).

2.6.3 Impact and Risk Classification

Environmental impacts and risks are assessed to determine the potential impact significance/consequence. The impact significance/consequence considers the magnitude of the impact or risk and the sensitivity of the potentially impacted receptor (represented by Figure 2-5).

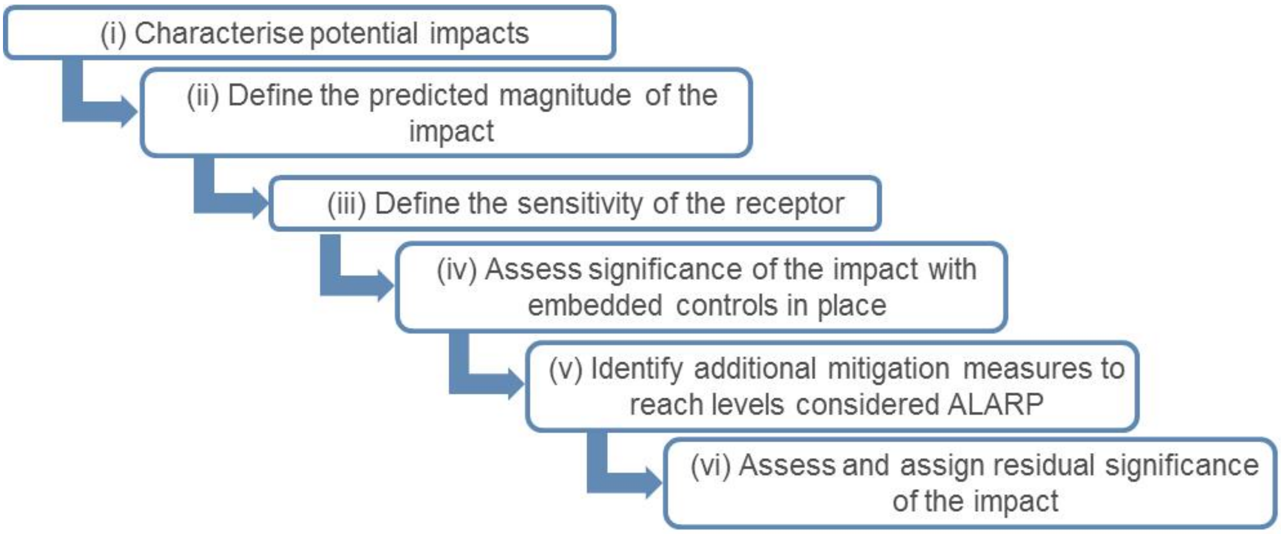


Figure 2-5: Environmental impact analysis

Impacts are classified in accordance with the consequence (Section 2.6.3) outlined in Woodside Risk Management Procedure and Risk Matrix.

Risks are assessed qualitatively and/or quantitatively in terms of both likelihood and consequence in accordance with the Woodside Risk Management Procedure and Risk Matrix.

The impact and risk information is summarised, including classification, and evaluation information as shown in the example (Table 2-2) for each planned activity and unplanned event evaluated.

2.6.3.1 Risk Rating Process

The risk rating process is undertaken to assign a level of risk to each risk event, measured in terms of consequence and likelihood. The assigned risk level is therefore determined after identifying the decision type and appropriate control measures.

The risk rating process considers the potential environmental consequences and where applicable, the social and cultural consequences of the risk. The risk ratings are assigned using the Woodside Risk Matrix (refer to Figure 2-6).

The risk rating process is performed using the following steps.

Select the Consequence Level

Determine the worst case credible consequence associated with the selected event, assuming all controls (preventative and mitigative) are absent or have failed (Table 2-3). Where more than one potential consequence applies, the highest severity consequence level is selected.

Table 2-3: Woodside risk matrix (environment and social and cultural) consequence descriptions

Environment	Social & Cultural	Consequence Level
Catastrophic, long-term impact (>50 years) on highly valued ecosystems, species, habitat or physical or biological attributes	Catastrophic, long-term impact (>20 years) to a community, social infrastructure or highly valued areas/items of international cultural significance	***A***
Major, long term impact (10–50 years) on highly valued ecosystems, species, habitat or physical or biological attributes	Major, long-term impact (5–20 years) to a community, social infrastructure or highly valued areas/items of national cultural significance	***B***
Moderate, medium-term impact (2–10 years) on ecosystems, species, habitat or physical or biological attributes	Moderate, medium term Impact (2–5 years) to a community, social infrastructure or highly valued areas/items of national cultural significance	***C***
Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystems function), physical or biological attributes	Minor, short-term impact (1–2 years) to a community or highly valued areas/items of cultural significance	***D***
Slight, short-term impact (<1 year) on species, habitat (but not affecting ecosystems function), physical or biological attributes	Slight, short-term impact (<1 year) to a community or areas/items of cultural significance	***E***
No lasting effect (<1 month). Localised impact not significant to environmental receptors	No lasting effect (<1 month). Localised impact not significant to areas/items of cultural significance	***F***

Select the Likelihood Level

Determine the description that best fits the chance of the selected consequence occurring, assuming reasonable effectiveness of the prevention and mitigation controls (Table 2-4).

Table 2-4: Woodside risk matrix likelihood levels

Likelihood Description						
Frequency	1 in 100,000–1,000,000 years	1 in 10,000–100,000 years	1 in 1000–10,000 years	1 in 100–1000 years	1 in 10–100 years	>1 in 10 years
Experience	**Remote**: Unheard of in the industry	**Highly Unlikely**: Has occurred once or twice in the industry	**Unlikely**: Has occurred many times in the industry but not at Woodside	**Possible**: Has occurred once or twice in Woodside or may possibly occur	**Likely**: Has occurred frequently at Woodside or is likely to occur	**Highly Likely**: Has occurred frequently at the location or is expected to occur
Likelihood Level	**0**	**1**	**2**	**3**	**4**	**5**

Calculate the Risk Rating

The risk level is derived from the consequence and likelihood levels determined above in accordance with the risk matrix shown in Figure 2-6. A likelihood and risk rating is only applied to environmental risks using the Woodside Risk Matrix.

This risk level is used as an input into the risk evaluation process and ultimately for prioritising further risk reduction measures. Once each risk is treated to ALARP, the risk rating articulates the ALARP baseline risk as an output of the ENVID studies.

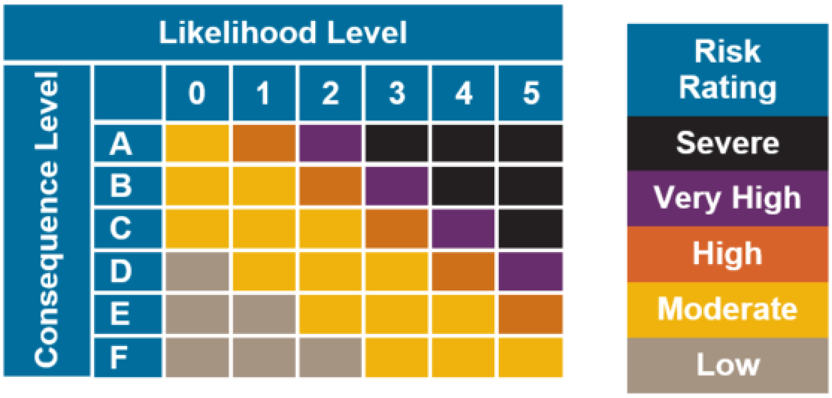


Figure 2-6: Woodside risk matrix: risk level

In support of ongoing risk management (as a key component of Woodside's Process Safety Management Framework – refer to Implementation Strategy (Section 7), Woodside uses the concept of 'current risk' and applies a current risk rating to indicate the current or 'live' level of risk, considering controls that are currently in place and regularly effective. Current Risk Classification is effective in articulating potential divergence from baseline risk, such as if certain controls fail or could potentially be compromised. Current risk ratings aid in communication and visibility of the risk events, and ensures risk is continually managed to ALARP by identifying risk reduction measures and assessing acceptability.

2.7 Impact and Risk Evaluation

Environmental impacts and risks cover a wider range of issues, affected by differing species, persistence, reversibility, resilience, cumulative effects and variability in severity. Determining the degree of environmental risk and the corresponding threshold for whether a risk/impact has been reduced to ALARP and is acceptable, is evaluated to a level appropriate to the nature and scale of each impact or risk. The evaluation considers:

- the Decision Type

- the Principles of Ecologically Sustainable Development as defined under the EPBC Act
- the internal context – the proposed controls and risk level are consistent with Woodside policies, procedures and standards (Section 6 and Appendix A)
- the external context – the environment consequence (Section 6) and stakeholder acceptability (Section 5) are considered
- other requirements – the proposed controls and risk level are consistent with national and international standards, laws and policies.

In accordance with Regulation 10A(a), 10A(b) and 10A(c), and 13(5)(b) of the Environment Regulations, Woodside applies the following process to demonstrate ALARP and acceptability for environmental impacts and risks appropriate to the nature and scale of each impact or risk.

2.7.1 Demonstration of ALARP

Descriptions have been provided in Table 2-5 to articulate how Woodside demonstrates that different risks, impacts and Decision Types identified within the EP are ALARP.

Table 2-5: Summary of Woodside's criteria for demonstrating ALARP

<table>
<tr><th>Risk</th><th>Impact</th><th>Decision Type</th></tr>
<tr><td>Low and Moderate</td><td>Negligible, Slight, or Minor (D, E or F)</td><td>A</td></tr>
<tr><td colspan="3">Woodside demonstrates these Risks, Impacts and Decision Types are reduced to ALARP if:
• controls identified meet legislative requirements, industry codes and standards, applicable company requirements and industry guidelines
• further effort towards impact/risk reduction (beyond employing opportunistic measures) is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.</td></tr>
<tr><td>High, Very High or Severe</td><td>Moderate and above (A, B or C)</td><td>B and C</td></tr>
<tr><td colspan="3">Woodside demonstrates these higher order Risks, Impacts and Decision Types are reduced to ALARP (where it can be demonstrated using good industry practice and risk based analysis) if:
• legislative requirements, applicable company requirements and industry codes and standards are met
• societal concerns are accounted for
• the alternative control measures are grossly disproportionate to the benefit gained.</td></tr>
</table>

2.7.2 Demonstration of Acceptability

Descriptions have been provided in Table 2-6 to articulate how Woodside demonstrates that different risks and impacts identified within the EP are of an Acceptable level appropriate to Decision Type and level of predicted risk or impact. This process aligns with NOPSEMA's Environment Plan Decision Making Guideline (GL1721 Rev 5, June 2018).

Table 2-6: Summary of Woodside's criteria for Acceptability

<table>
<tr><th>Risk</th><th>Impact</th><th>Decision Type</th></tr>
<tr><td>Low and Moderate</td><td>Negligible, Slight, or Minor (D, E or F)</td><td>A</td></tr>
<tr><td colspan="3">Woodside demonstrates these lower order Risks, Impacts and Decision Types are 'Broadly Acceptable' if they meet legislative requirements, industry codes and standards, applicable company requirements and industry guidelines. Further effort towards reducing risk (beyond employing opportunistic measures) is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.</td></tr>
<tr><td>High, Very High or Severe</td><td>Moderate and above (A, B or C)</td><td>B and C</td></tr>
<tr><td colspan="3">Woodside demonstrates these higher order risks, impacts and decision types are 'Acceptable' if it can be demonstrated that the predicted levels of impact and/or residual risk, are:
• at or below the defined acceptable level(s) for that impact or risk, and
• managed to ALARP (as described in Section 2.7.1).</td></tr>
</table>

<table>
<tr><th>Risk</th><th>Impact</th><th>Decision Type</th></tr>
<tr><td colspan="3">Acceptable levels are defined appropriate to the nature and scale of each impact and risk and in consideration of the following criteria:
the Principles of Ecological Sustainable Development as defined under the EPBC Act
the internal context – the proposed controls and consequence/risk level are consistent with Woodside policies, procedures and standards
the external context – consideration of the environment consequence (Section 6) and stakeholder acceptability (Section 5) are considered
other requirements – the proposed controls and consequence/risk level are consistent with national and international industry standards, laws and policies ad consideration of applicable plans for management and conservation advices, conventions and significant impact guidelines (e.g. MNES).
Once acceptable levels have been defined, a statement of acceptability is made to summarise how a given impact/residual risk will be managed to at or below these levels and appropriate EPOs which are linked to these acceptable levels are established.
For potential C or above consequence/impact levels where significant uncertainty exists in analysis of the risk or impact (such as, for predicted or potential high risk of significant environmental impacts, significant project risk/exposure, novel activities, lack of consensus on standards, and significant stakeholder concerns. E.g. Decision Type C), defined acceptable levels and assessment of acceptability may be required to be conducted separately for key receptors.
Additionally, Very High and Severe risks require ‘Escalated Investigation’ and mitigation. If after further investigation the risk remains in the Very High or Severe category, the risk requires appropriate business engagement with increasing involvement of senior management in accordance with Woodside’s Risk Management Procedure to accept the risk. This includes due consideration of regulatory requirements.</td></tr>
</table>

2.8 Environmental Performance Objectives/Outcomes, Standards and Measurement Criteria

Environmental performance objectives/outcomes, standards, and measurement criteria are defined to address the potential environmental impacts and risks and are explored in Section 6.

2.9 Implementation, Monitoring, Review and Reporting

An implementation strategy for the Petroleum Activities Program describes the specific measures and arrangements to be implemented for the duration of the Petroleum Activities Program. The implementation strategy is based on the principles of Australian/New Zealand Standard International Standards Organization (AS/NZS ISO 14001) Environmental Management Systems, and demonstrates:

- Control measures are effective in reducing the environmental impacts and risks of the Petroleum Activities Program to ALARP and acceptable levels.
- Environmental performance outcomes and standards set out in the EP are met through monitoring, recording, audit, management of non-conformance and review.
- All environmental impacts and risks of the Petroleum Activities Program are periodically reviewed in accordance with Woodside’s risk management procedures.
- Roles and responsibilities are clearly defined, and personnel are competent and appropriately trained to implement the requirements set out in this EP, including in actual or potential emergencies.
- Arrangements are in place for oil pollution emergencies to respond to and monitor impacts.
- Environmental reporting requirements, including ‘reportable incidents’.
- Appropriate stakeholder consultation is undertaken throughout the activity.

The implementation strategy is presented in Section 7.

2.10 Stakeholder Consultation

A stakeholder assessment is performed to identify relevant persons (as defined under Regulation 11A of the Environment Regulations) to whom an activity update is issued electronically to provide a reasonable consultation period. Further details and information is provided to any stakeholder if requested.

A summary and assessment of each stakeholder response is performed and a response, where appropriate, is provided by Woodside.

The stakeholder consultation, along with the process for ongoing engagement and consultation throughout the activity, is presented in Section 5.

3 DESCRIPTION OF THE ACTIVITY

3.1 Overview

This section has been prepared in accordance with Regulation 13(1) of the Environment Regulations and describes the activities to be undertaken as part of the Petroleum Activities Program under this EP. It includes the location of the activity, the operational details of the activity, and additional information relevant to consideration of environmental risks and impacts.

An overview of the Petroleum Activities Program is provided in Table 3-1.

Table 3-1: Petroleum Activities Program overview

Item	Description
Permit Area	WA-49-L
Location	Barrow sub-basin
Water depth	Approximately 166–511 m
Vessels	Anchor handling vessel (AHV); support vessel (optional)
Key activities	Anchor hold testing

3.2 Location

The proposed Petroleum Activities Program is located in Permit Area WA-49-L, in Commonwealth waters in the Barrow Sub-basin, about 138 kilometres (km) off the Pilbara coast of Western Australia (WA) (Figure 3-1). The closest landfall to the location is the Montebello Islands, which are about 51 km south-east.

Approximate location details for the Petroleum Activities Program are provided in Table 3-2. The well location defines the centre of the Operational Area (Section 3.3).

Table 3-2: Approximate location details for the Petroleum Activities Program

Activity	Water Depth (Approx. m LAT)	Latitude	Longitude	Petroleum Titles
Gemtree-A well (proposed)	201	20º02’ 06.754 S	115 º 06’ 32.749 E	WA-49-L

3.3 Operational Area

The Operational Area defines the spatial boundary of the Petroleum Activities Program, as described, risk assessed and managed by this EP, including vessel-related petroleum activities within the Operational Area[3].

For the purposes of this EP, the Operational Area encompasses a radius of 4000 metres (m) from the proposed Gemtree-A well centre, within the WA-49-L Permit Area (Figure 3-1). The 4000 m Operational Area allows for anchor hold testing activities at potential mooring locations and vessel mobility.

[3] Vessels supporting the Petroleum Activities Program operating outside of the Operational Area (e.g. transiting to and from port) are subject to all applicable maritime regulations and other requirements, which are not managed under this EP.

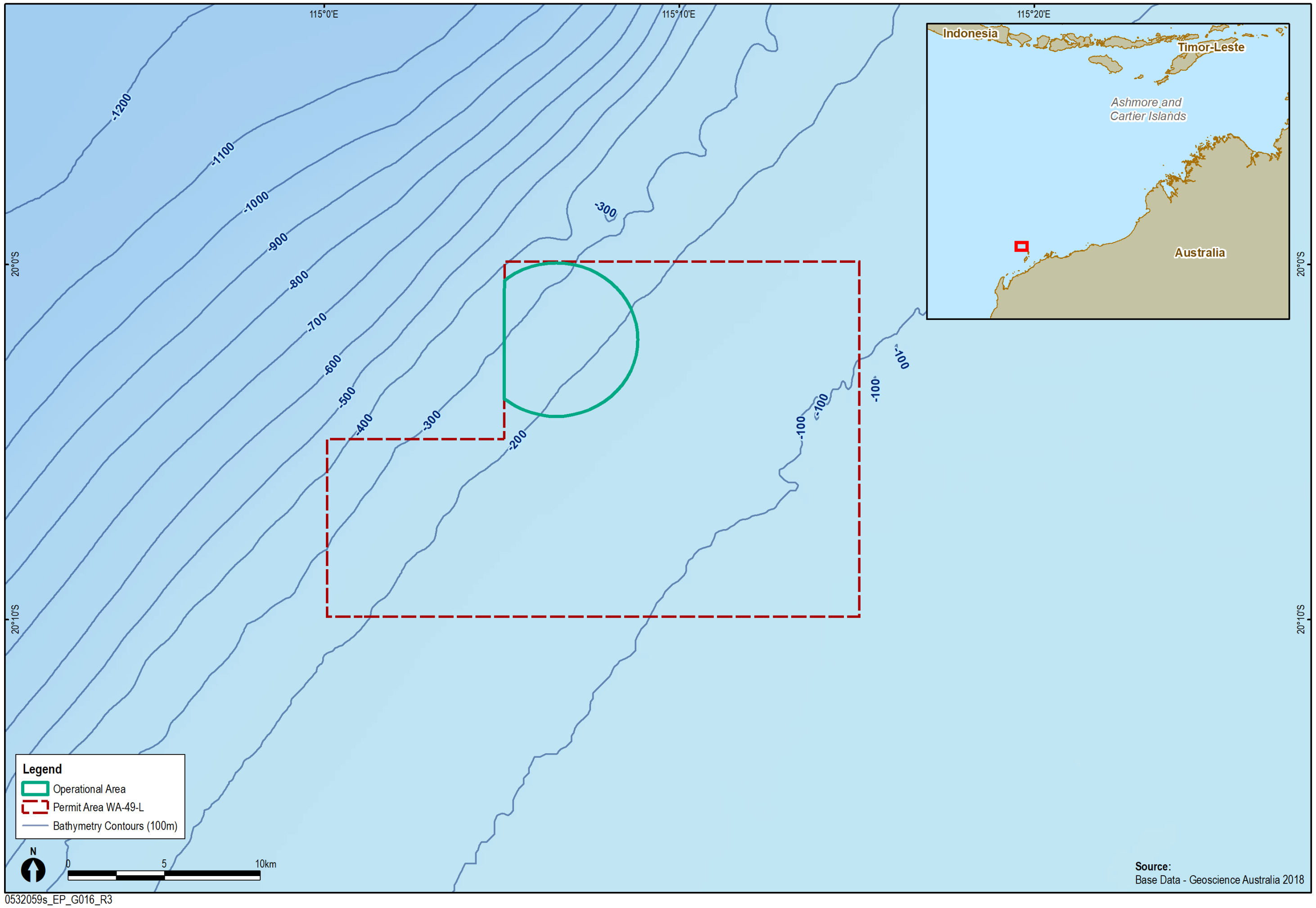


Figure 3-1: Location of the proposed anchor hold testing Operational Area

3.4 Timing

The proposed Petroleum Activities Program is scheduled to commence in Q1 2020. The anchor hold testing is expected to take approximately 14 days (including mobilisation, demobilisation and contingency) to complete.

Timing and duration of these activities is subject to change due to project schedule requirements, vessel availability, unforeseen circumstances and weather.

The EP has risk assessed the activities to occur at any time throughout the year (all seasons) to provide operational flexibility for requirements, schedule changes and vessel availability.

3.5 Project Vessels

One anchor handling vessel (AHV) will be required to complete the activities associated with the Petroleum Activities Program. The AHV is a specialised vessel designed to handle large anchors and the anchor chain/wire in an offshore environment (Figure 3-2). An AHV features a large deck space, cranes, primary and auxiliary winches, large chain/wire storage capacity and chain lockers.

Figure 3-2: Typical AHV for Anchor Testing Scope (Source: www.solstad.com)

A support vessel may also accompany the AHV, as required. The support vessel may be used to transport equipment and materials between the AHV and port. The support vessel may transit between the Operational Area and NWS ports including Dampier, Onslow and Exmouth. The support vessel will not anchor within the Operational Area during the activities due to water depth; instead the vessel will utilise Dynamic Positioning (DP) for station keeping. Due to the relatively short duration of the Petroleum Activities Program, the AHV will likely be able to conduct the activity as a sole vessel and the use of a support vessel may not be necessary. However, a support vessel has been included in this EP for contingency.

Table 3-3 outlines typical parameters of the vessels that will be used during the Petroleum Activities Program.

Table 3-3: Typical vessel specifications

Specification	AHV	Support Vessel
Net Registered tonnage	~2000	~2000
Length overall	~87 m	~95 m
Breadth	~21 m	~21 m
Draft (max)	~8 m	~7 m
Persons on board	40	25

For power generation, vessels may use diesel-powered generators and/or LNG. All vessels will display navigational lighting and external lighting, as required for safe operations. Lighting levels will be determined primarily by operational safety and navigational requirements under relevant legislation, specifically the *Navigation Act 2012*. The vessels will be lit to maintain operational safety on a 24-hour basis.

All vessels are subject to the Marine Offshore Assurance process and review of the Offshore Vessel Inspection Database (OVID). All required audits and inspections will assess compliance with the laws of the international shipping industry, which includes safety and environmental management requirements, and maritime legislation including International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL) and other International Maritime Organization (IMO) standards.

A description and assessment of vessel-related environmental impacts and risks, credible spill scenarios and environmental sensitivities for the activities within the scope of this EP are included in Section 6.

3.6 Other Support

The AHV and support vessel may be equipped with a Remotely Operated Underwater Vehicle (ROV) system that is maintained and operated by a specialised contractor aboard the vessel. An ROV may be used during anchor handling testing operations to inspect the seabed following anchor tensioning to check level of anchor embedment.

The ROV can be fitted with various tools and camera systems that can be used to capture permanent records (both still images and video) of the operations and immediate surrounding environment.

3.7 Anchor Hold Testing

Anchor hold testing involves deploying and tensioning an anchor at proposed anchor locations to determine the performance and behaviour of the anchor. The results of test will be used to generate equivalent anchor Ultimate Holding Capacity (UHC) values which will be used as inputs for a detailed mooring design to the Mobile Offshore Drilling Unit (MODU) for the proposed Gemtree-A exploration well that is compliant with industry and company standards.

Anchor hold testing may consist of an AHV deploying an anchor at a potential mooring location. The AHV would then apply tension on the anchor and log its performance based on hold tension, drag distance and embedment. The AHV will deploy drag embedment anchors designed to penetrate the seabed to a target penetration depth of approximately 10 m (Figure 3-3). Drag embedment anchors are suitable for the activity as they are designed to resist large horizontal loads (such as mooring a MODU). Ultra-short baseline (USBL) transponders will be attached to the anchors to assist with positioning.

Up to ten locations within the Operational Area will be tested using a seven tonne anchor and a twenty tonne anchor. A fifteen tonne anchor will also be carried as an optional component. Therefore, up to 30 anchor deployments are proposed as part of this activity (i.e. up to ten deployments with up to three anchor tests at each location). However, it is likely that fewer than 30 deployments will be required to complete the activity. An ROV may also be used to judge how deep the anchor has embedded and independently verify the seabed condition.

Once tests are completed at one location, the AHV will retrieve the anchor from the seabed and continue to the next location. Anchor hold testing is temporary and no equipment will be left on the seabed upon completion of the activity.

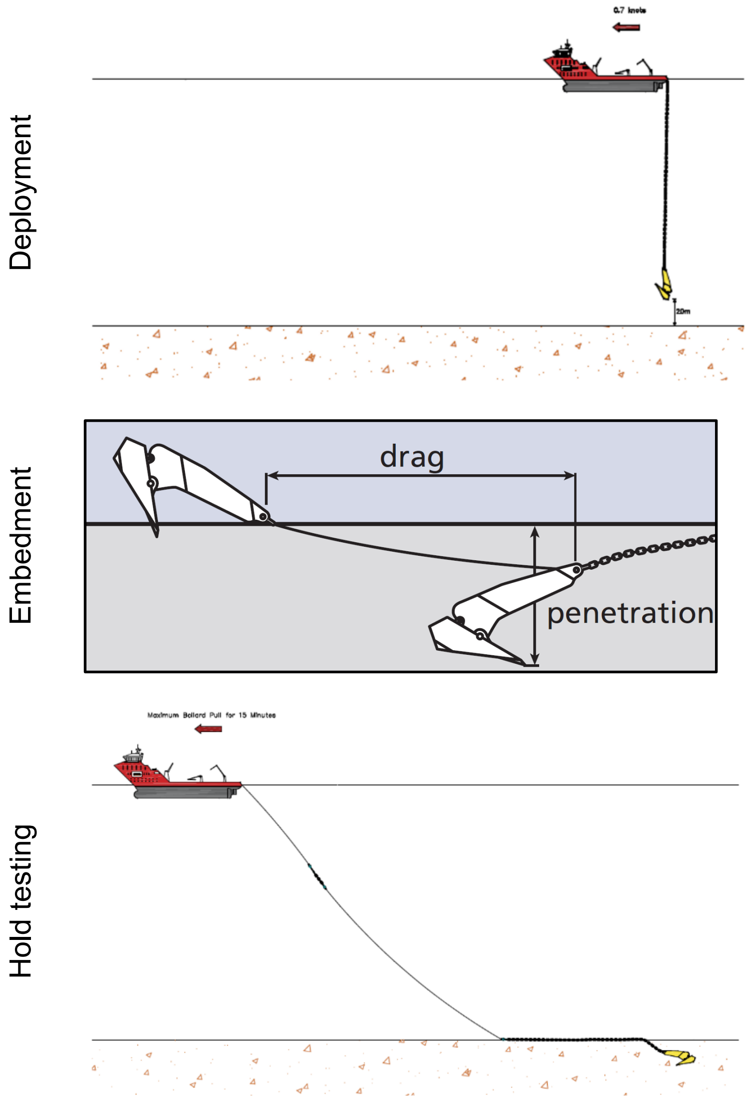


Figure 3-3: Anchor hold testing – indicative schematic (adapted from WEL procedure)

4 DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 Overview

In accordance with Regulation 13(2) and 13(3) of the Environment Regulations, a description of the existing environment that may be affected (EMBA) by the activity (planned and unplanned activities, as defined in Section 2.4.1 and described in Section 3), including details of the particular relevant values and sensitivities of the environment, is provided in this section and has been used for the risk assessment.

For the purposes of this EP, Woodside has identified the EMBA by combining the potential spatial extent of surface and in-water (dissolved and entrained) hydrocarbons above threshold concentrations, resulting from a worst-case credible spill from a vessel. Note that no shoreline accumulation of hydrocarbons above threshold concentrations resulted from the modelled worst-case credible spill.

Hydrocarbon exposure thresholds used to define the EMBA are outlined in Table 4-1 and shown in Figure 4-1. It should be noted that the EMBA presented does not represent the predicted coverage of any one hydrocarbon spill or a depiction of a slick or plume at any particular instance in time. Rather, the contours are a composite of a large number of theoretical slick paths, integrated over the full duration of the simulations under various metocean conditions.

Woodside recognises that surface hydrocarbons may be present at lower concentrations than the EMBA threshold value of 10 g/m^2, that may be visible, but are not expected to cause ecological impacts. Surface oil may be visible to a concentration of approximately 1 g/m^2.

Woodside has therefore used this as a threshold to define an additional boundary within which socio-cultural impacts to the visual amenity of the marine environment may occur. This additional area is referred to as the socio-cultural EMBA in this EP. Socio-cultural values described within this EMBA include the following:

- protected areas
- National and Commonwealth Heritage Listed places
- tourism and recreation
- fisheries.

Table 4-1 Hydrocarbon spill thresholds used to define EMBA for surface and in-water hydrocarbons

Hydrocarbon type	EMBA[1]	Socio-cultural EMBA
Surface	10 g/m^2 This represents the minimum oil thickness (0.01 mm) at which ecological impacts (e.g. to birds and marine mammals) are expected to occur.	1 g/m^2 This represents a wider area where a visible sheen may be present on the surface but is below concentrations at which ecological impacts are expected to occur.
Dissolved	500 Parts per Billion (ppb) This represents potential toxic effects, particularly sublethal effects to highlight sensitive species. The threshold concentration value for dissolved hydrocarbons has been established with reference to results from Woodside-	N/A

Hydrocarbon type	EMBA[1]	Socio-cultural EMBA
	commissioned ecotoxicity tests on Marine Diesel Oil (Ecotox Services Australia [ESA 2013], **Section 6.7.1**).	
Entrained	500 ppb Entrained droplets may contain soluble compounds and hence have the potential for generating elevated concentrations of dissolved hydrocarbons. However, the potential for physical and chemical effects from direct contact with entrained oil droplets, which are less biologically available, is more applicable. An entrained threshold of 500 ppb, consistent with the threshold for toxicity from dissolved components, is therefore considered to be conservative.	N/A

[1] Further details including the source of the thresholds used to define the EMBA in this table are provided in Section 6.7.1.

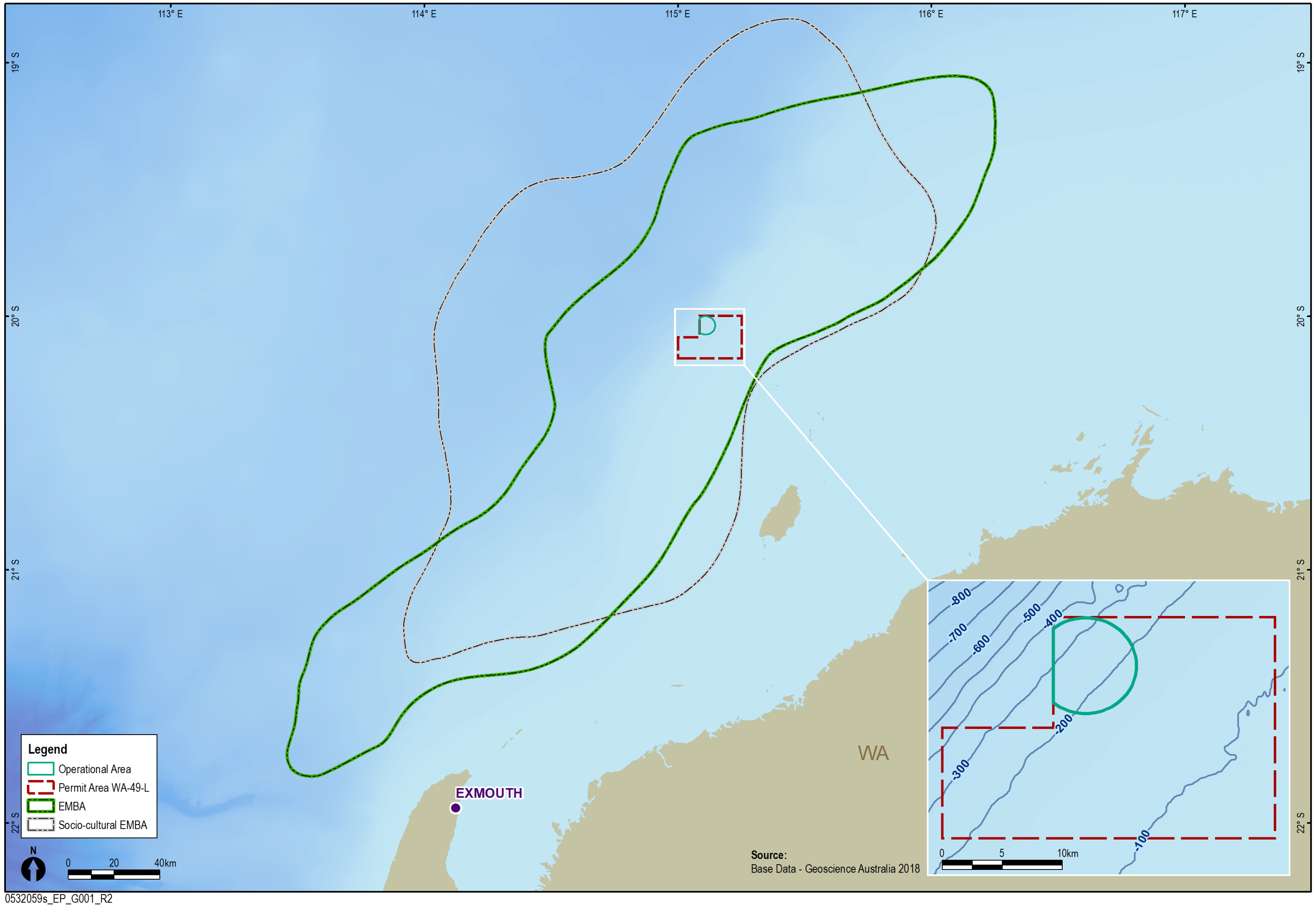


Figure 4-1: EMBA and socio-cultural EMBA

4.2 Summary of Key Existing Environment Characteristics

A summary of the key existing environment characteristics, consistent with the process of identifying and describing the existing environment in relation to the 'nature and scale' of the activity (refer Section 2.4.2) is provided in Table 4-2. The key existing environment characteristics in Table 4-2 are described in terms of the Operational Area and the EMBA (as described in Section 4.1).

Table 4-2: Summary of key existing environment characteristics

	Sensitive receptor	EP section	Description
Physical Habitats	***Climate and meteorology***	***4.4.1***	***Operational Area and EMBA*** • Dry tropical climate with hot summers and mild winters. • Tropical monsoon climate, with distinct wet (October to April) and dry (May to September) seasons. • Winds vary seasonally, with a tendency for winds from the south-west during summer months (September to March) and the south-east in autumn and winter months (April to August). • Tropical cyclone activity can occur between November and April (summer period) and is most frequent during January to March.
Physical Habitats	***Oceonography and Seawater characteristics***	***4.4.2*** ***4.4.3***	***Operational Area*** • Water quality is expected to reflect the offshore oceanic conditions of the Northwest Shelf Province and wider region. • Surface water temperatures are relatively warm, ranging seasonally from about 24.3 to 28.5 °C. • Offshore waters are expected to be of high quality, given the distance from shore and lack of terrigenous inputs. ***EMBA*** • Water quality is regulated by the Indonesian Throughflow (ITF), which plays a key role in initiating the Leeuwin Current and brings warm, low-nutrient, low-salinity water to the North-west Marine Region (NWMR). It is the primary driver of the oceanographic and ecological processes in the Northwest Shelf Province. • Tidally-driven currents are also a significant component of water movement along the NWS. • Variation in surface salinity throughout the year is minimal (35.2 and 35.7 practical salinity units (PSU)). • During summer, the Leeuwin Current typically weakens and the Ningaloo Current develops, facilitating upwelling of cold, nutrient-rich waters up onto the NWS. • Other areas of localised upwelling in the NWMR include the Wallaby Saddle and the northern and southern margins of the Exmouth Plateau, where these seabed topographical features and internal waves force the surrounding deeper, cooler, nutrient-rich waters up into the photic zone. • Turbidity is primarily influenced by sediment transport by oceanic swells and primary productivity.
Physical Habitats	***Bathymetry and seabed habitats***	***4.4.4***	**Bathymetry and Seabed Features** ***Operational Area*** • Located in waters about 166–511 m deep along the middle continental shelf. • The seabed generally comprises a relatively flat and featureless habitat with noted features being: – The north-east portion of the Operational Area overlaps with an area of seabed known as the ‘upper slope,’ at which the continental shelf transitions to the continental slope.

	Sensitive receptor	EP section	Description
			– The Operational Area overlaps spatially with the Continental Slope Demersal Fish Communities key ecological feature (KEF) (Section 4.7.3). ***EMBA*** • The EMBA includes a number of topographic features including submerged banks, shoals and valleys, including Rankin Bank. • It is characterised by the middle continental shelf, the outer shelf/continental slope and the abyssal plain. • Broad-scale, biologically important deep-sea seabed habitat includes abyssal plains, marginal plateaus and submarine canyons. **Marine Sediment** ***Operational Area*** • The Operational Area is dominated by soft sediment (muddy substrates to coarse sands). ***EMBA*** • Sediments are relatively homogenous and are typically dominated by sands and a small portion of gravel. • Rankin Bank is comprised predominantly of sand (similar to other shoal ecosystems on the NWS) and are considered pristine marine environments.
	Air quality	***4.4.5***	There is limited air quality data for the Northwest Shelf Province and EMBA but ambient air quality in the Operational Area and EMBA is expected to be of high quality.
	Critical habitat – EPBC listed	***4.5.1***	No Critical Habitats or Threatened Ecological Communities, as listed under the EPBC Act, are known to occur within, or in proximity to, the Operational Area or EMBA.
	Marine primary producers	***4.5.1***	**Coral Reefs** ***Operational Area*** • No coral reefs have been identified within or adjacent to the Operational Area. ***EMBA*** • The nearest coral reef habitat to the Operational Area is at Rankin Bank, about 40 km to the north-east. **Seagrass/Macroalgae** ***Operational Area*** • No seagrass beds or macroalgal habitat has been identified in the Operational Area. ***EMBA*** • The nearest seagrass/macroalgal habitat is south-east of the Operational Area in shallow waters around Montebello/Barrow/Lowendal Islands Group, within the EMBA.

Sensitive receptor	EP section	Description
		Mangroves ***Operational Area*** • No mangrove habitat has been identified within the Operational Area. ***EMBA*** • No mangrove habitat occurs within the EMBA. The nearest mangrove habitats are located about 51 km south-east of the Operational Area at the Montebello/Barrow/Lowendal Islands Group.
Other communities and habitats	***4.5.1***	**Plankton** ***Operational Area*** • Plankton communities in the Operational Area are likely to reflect the broader NWMR. ***EMBA*** • Offshore phytoplankton communities are characterised by smaller taxa (e.g. bacteria) whereas shelf waters are dominated by larger taxa such as diatoms. **Pelagic and Demersal Fish Communities** ***Operational Area*** • Fish communities in the Operational Area comprise small and large species of pelagic fish, as well as demersal species. • The Continental Slope Demersal Fish Communities KEF (overlapping the Operational Area) supports a high biodiversity of demersal fish species. • Demersal fish biodiversity correlates with habitat complexity, with more complex habitat supporting greater species richness and abundance compared to bare areas. ***EMBA*** • Rankin Bank support high demersal fish richness and abundance compared to other shoals and reef locations along the NWS. **Benthic Fauna Communities (including filter feeders)** ***Operational Area*** • Soft sediment communities located within and adjacent to the Operational Area include sparse (<5% cover) epibenthic fauna comprising occasional anemones, urchins, sea whips, sea pens, feather stars and glass sponges. Infauna are diverse and dominated by polychaete worms and crustaceans. • The benthic (epifauna and infauna) biota associated with the soft sediment habitat of the Operational Area is expected to be relatively homogenous across the region. This habitat is considered to be of relatively low environmental sensitivity. ***EMBA*** • Hard coral and macroalgae communities of Rankin Bank (refer to Section 4.7.4).

	Sensitive receptor	EP section	Description
			• Filter feeding communities associated with cemented sediment outcropping and other hard substrate habitats are recorded throughout the EMBA. Recorded locations of such communities include the deeper waters surrounding Rankin Bank.
Protected Species	***Biologically important areas (BIAs)***	***4.5.2***	***Operational Area*** • Flatback turtle internesting buffer BIA; Overlaps the periphery of a flatback turtle internesting zone, which is an approximately 80 km buffer zone from the nearest foraging, mating and nesting sites for flatback turtles on Barrow, the Montebello and Lowendal Islands during summer (peak period in December and January). • Overlaps the whale shark foraging BIA extending north of Ningaloo Reef/North West Cape along the 200 m isobath (July–November). • Overlaps a foraging area for the wedge-tailed shearwater; during its breeding season (August–April). • Overlaps a small portion of the blue whale migration corridor, which extends northward from the Perth canyon towards Indonesia (northward migration April–August; southern migration October–December). ***EMBA*** • There are three additional BIAs within the EMBA (refer to Section 4.5.2.3).
	Marine mammals	***4.5.2***	***Operational Area*** • Marine mammals identified from the EPBC Act Protected Matters Search Tool (PMST) included four species of Threatened and Migratory cetaceans (the pygmy blue, humpback, sei and fin whale) and four species of Migratory cetaceans that may be present in the Operational Area (Bryde's whale, killer whale, sperm whale and spotted bottlenose dolphin (Arafura/Timor Sea populations). • The Operational Area does not contain any known critical habitat for any species of marine mammal. ***EMBA*** • Additional threatened and/or migratory species identified as occurring within the EMBA include the southern right whale, Antarctic minke whale, and Indo-Pacific humpback dolphin. See Section 4.7.1 to Section 4.7.4 for the location of identified values and sensitivities, related to marine mammals, which are protected within the jurisdiction of Commonwealth and State managed areas.
	Marine turtles	***4.5.2***	***Operational Area*** • Five species of Threatened marine turtles (loggerhead, green, leatherback, hawksbill and flatback) may occur in the Operational Area. • The Operational Area partially overlaps an internesting buffer (60 km) for flatback turtles around Montebello Islands, listed as habitat critical to the survival of marine turtles. This area has also been defined as an internesting BIA for flatback turtles which extends 80 km from the Montebello Islands.

Sensitive receptor	EP section	Description
		• The presence of marine turtles within the Operational Area is likely to be infrequent and limited to individuals or small numbers transiting through the area due to the distance from shore and water depths. ***EMBA*** • Marine turtles may forage around Rankin Bank, given the relatively shallow depths and suitable foraging habitat. • Leatherback turtles may occur in low numbers within the EMBA but there are no known nesting beaches in WA.
Seasnakes	***4.5.2***	***Operational Area*** • Given the offshore location and deeper water depths of the Operational Area, seasnake sightings will likely be infrequent and comprise a few individuals. ***EMBA*** • Seasnakes frequent the waters of the continental shelf area (between 10 and 120 m) in the Northwest Shelf Province and around offshore islands. • The short-nosed seasnake (Critically Endangered) was identified by the EPBC Act PMST as potentially occurring within the EMBA.
Seahorses, pipehorses and pipefishes	***4.5.2***	***Operational Area*** • Seahorses, pipehorses and pipefishes are uncommon in deeper continental shelf waters (50–200 m) and therefore unlikely to occur within the Operational Area. ***EMBA*** • Seahorses, pipehorses and pipefishes occur in both temperate and tropical waters throughout the NWMR and are commonly found among seagrass, mangrove, coral reef and sandy habitats around coastal islands and shallow reef areas.
Sharks and rays	***4.5.2***	***Operational Area*** • The EPBC Act PMST identified three species of Threatened and Migratory sharks (whale shark, great white shark and green sawfish), one species of Threatened shark (grey nurse shark), three species of Migratory sharks (shortfin mako, longfin mako and narrow sawfish) and two Migratory ray species (giant manta ray and reef manta ray) that may occur in the Operational Area. • The Operational Area does not contain any known critical habitat for any species of shark or ray. However, a BIA representing foraging area for whale sharks overlaps the Operational Area; therefore, whale sharks may traverse the Operational Area during their migration between Australia and Indonesia each year. • The presence of EPBC-listed sharks and rays is likely to be infrequent and limited to individuals or small numbers transiting through the area. ***EMBA*** • Whale sharks are known to aggregate annually, from March to July, in areas off Ningaloo and North West Cape (over 200 km from the Operational Area and beyond the EMBA). After the aggregation period, the distribution of the whale sharks is largely

	Sensitive receptor	EP section	Description
			unknown but surveys suggest the group disperses widely and up to 1800 km away to areas in Indonesia, Christmas Island and Coral Sea. • Grey nurse sharks are likely to be found in shallow waters of the EMBA. • Great white sharks, shortfin makos and longfin makos are all known to occur within the EMBA. • Manta rays are known to occur in tropical waters throughout the EMBA. • Dwarf sawfish may be present within shallower waters at south and south-east extent of the EMBA. See Section 4.7.1 to Section 4.7.4 for the location of identified values and sensitivities, related to sharks and rays, which are protected within the jurisdiction of Commonwealth and State managed areas.
	Seabirds and/or migratory shorebirds	***4.5.2***	***Operational Area*** • Twelve listed threatened and/or migratory bird species were identified in the EPBC Protective Matters Search Tool as potentially occurring within the Operational Area, five of which are listed as threatened. No critical habitat associated with these species has been identified for the Operational Area. • A BIA for wedge-tailed shearwater foraging, used during their breeding season (August to April), overlaps the Operational Area. ***EMBA*** • A BIA for wedge-tailed shearwater breeding (Pilbara South Island Group) is located within the EMBA. Seabird and shorebird habitats are discussed further as key environmental sensitivities in Section 4.7.1 to Section 4.7.4
Socio-economic	***Cultural heritage***	***4.6.1***	***Operational Area*** • There are no known sites of Indigenous or European cultural or heritage significance within or in the vicinity of the Operational Area. • There are no heritage listed sites within or immediately adjacent to the Operational Area. ***EMBA*** • No registered Aboriginal heritage sites (based on results from Department of Aboriginal Affairs (DAA) searches occur within the EMBA. • The no historic shipwrecks or sunken aircraft within the EMBA. • There are no National and Commonwealth heritage listed sites within the EMBA. ***Socio-cultural EMBA*** • No National or Commonwealth Heritage Places occur within the socio-cultural EMBA.
	Ramsar wetlands	***4.6.2***	No Ramsar wetlands occur within or nearby the Operational Area or EMBA.

	Sensitive receptor	EP section	Description
	Fisheries – commercial	***4.6.3***	***Operational Area*** There are a number of fisheries extending over the Operational Area; however, only the North West Slope Trawl Fishery and Pilbara Line Fishery are expected to be active nearby, or within the Operational Area: • Commonwealth fisheries are: – North West Slope Trawl Fishery – Western Tuna and Billfish Fishery – Western Skipjack Fishery – Southern Bluefin Tuna Fishery. • State fisheries are: – West Australian Mackerel Fishery – Pearl Oyster Managed Fishery – Beche-de-mer Fishery – Marine Aquarium Managed Fishery – Specimen Shell Managed Fishery – Pilbara Demersal Scalefish Fisheries (Pilbara Trawl, Trap and Line) – Onslow Prawn Managed Fishery – Southwest Coast Salmon Managed Fishery – West Coast Deep Sea Crustacean Managed Fishery – Abalone Fishery. • There are no aquaculture activities within or adjacent to the Operational Area. ***EMBA*** • Commonwealth fisheries are: – Western Deepwater Trawl Fishery.
	Fisheries – traditional	***4.6.3***	***Operational Area*** • There are no traditional or customary fisheries within or adjacent to the offshore Operational Area. ***EMBA*** • Traditional fisheries are typically restricted to shallow coastal waters and/or areas with structures such as reefs. Therefore no traditional or customary fishing activity occurs within the EMBA.

	Sensitive receptor	EP section	Description
	Tourism and Recreation	***4.6.5***	***Operational Area*** • No tourism activities are known to take place specifically within the Operational Area due to water depths and distance offshore. ***EMBA*** • Recreational fishing occasionally occurs at Rankin Bank. • The Montebello Islands are popular for marine nature-based tourism activities.
	Shipping	***4.6.6***	***Operational Area*** • No Australian Maritime Safety Authority (AMSA) shipping fairways overlap the Operational Area. • AMSA data indicates light shipping traffic within the Operational Area. ***EMBA*** • The coastal and offshore waters of the region support significant commercial shipping activity, the majority of which is associated with the mining and oil & gas industries. • Major shipping routes are associated with entry to the ports of Port Hedland, Dampier and Barrow Island.
	Oil & gas and other infrastructure	***4.6.7***	***Operational Area*** • The Operational Area is located within an area of established oil and gas operations, including subsea infrastructure associated with the Brunello field development located within the north end of the Operational Area, and Julimar field development adjacent to the Operational Area. ***EMBA*** • The Pluto Platform and the Wheatstone Platform are located 23 km and 27 km from the Operational Area respectively. • John Brookes Platform, Goodwyn Facility, East Spar Platform and North Rankin Complex are between 29 and 108 km from the Operational Area.
	Defence	***4.6.8***	***Operational Area*** • The Operational Area overlaps with the northern tip of one of the Department of Defence's practice areas.
Protected Areas	*The following Protected Areas and sites of high conservation value are located outside of the Operational Area and are considered due to the extent of the EMBA and Socio-cultural EMBA:*		
	Montebellos/ Barrow/Lowendal Islands	***4.7.1***	Protected areas in this locality include: • Montebello AMP (see Section 4.7.1).
	Gascoyne region	***4.7.2***	Protected areas in this locality include: • Gascoyne AMP.

	Sensitive receptor	EP section	Description
	Key Ecological Features	***4.7.3***	KEFs within the Operational Area include: • Continental Slope Demersal Fish Communities are a KEF due to the notable diversity of the demersal fish assemblages and high levels of endemism. KEFs within the EMBA include: • Ancient Coastline at 125 m Depth Contour. • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula
	Other sensitive areas	***4.7.4***	Other sensitive areas within the EMBA include: • Rankin Bank.

4.3 Regional Context

The Operational Area is located in Commonwealth waters within the NWS, in water depths of about 166–511 m. The Operational Area is located predominantly within the Northwest Province but also overlaps the Northwest Shelf Province (Figure 4-2), as defined under the Integrated Marine and Coastal Regionalisation of Australia (IMCRA v4.0). Both Provinces are part of the wider NWMR. The Northwest Province encompasses Commonwealth waters of the continental slope between Exmouth and Port Hedland, covering 16.7% of the NWMR at depths predominantly between 1000 and 3000 m. The Northwest Shelf Province encompasses the continental shelf between North West Cape and Cape Bougainville and varies in width from about 50 km at Exmouth Gulf to greater than 250 km off Cape Leveque. It includes water depths of 0–200 m (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2008a).

The Northwest Province is characterised by the following biophysical features (DEWHA, 2008a):

- Transitional climatic conditions occur between dry tropics to the south and humid tropics to the north.
- There are strong seasonal winds and moderate offshore tropical cyclone activity, with cyclone frequency and intensity increases in summer.
- Narrowing of the continental shelf at North West Cape consolidates southward moving surface waters and begins the Leeuwin Current. The Leeuwin Current is 50–100 km wide and less than 300 m deep, and is undercut by the Leeuwin Undercurrent which flows northward between 250 and 450 m deep.
- The ITF is the dominant surface flow within the bioregion, which is influenced by seasonal and inter-annual variations described above.
- The Exmouth Plateau is the largest topographic feature of this bioregion, covering an area of 50,000 km² (Baker et al., 2008). The surface of the plateau is generally rough and undulating with water depths of about 500–5000m, and is thought to modify the flow of deep waters and potentially uplift deep nutrient rich waters to the surface. (Brewer et al., 2007).
- The North West Cape is a boundary point for a transition in demersal shelf and slope fish communities, with temperate communities to the south and tropical dominated communities to the north (Last et al., 2005).
- The Montebello Trough occurs on the eastern side of the Exmouth Plateau and represents more than 90% of the area of troughs in the NWMR (Baker et al., 2008).
- With over 500 fish species, 76 of which are endemic, the continental slope between the North West Cape and the Montebello Trough has been identified as one of the most diverse slope habitats of Australia.
- Benthic communities likely include filter feeders and epifauna, such as sea cucumbers, ophiuroids, echinoderms, polychaetes and sea-pens. These epibenthos are likely to have a patchy distribution across soft-bottom environments within the region.
- Internationally significant migratory routes, resident populations, breeding and/or feeding grounds for a number of EPBC Act listed Threatened and Migratory marine species are present, including humpback whales, marine turtles, whale sharks, seabirds and migratory shorebirds.
- Other NWMR bioregions within the EMBA include the Northwest Transition, Central Western Transition, the Central Western Shelf Transition and the Central Western Shelf Province.

The Northwest Shelf Province is characterised by the following biophysical features (DEWHA, 2008):

- Transitional climatic conditions occur between dry tropics to the south and humid tropics to the north.
- There are strong seasonal winds and moderate offshore tropical cyclone activity, with cyclone frequency and intensity increases in summer.
- Deeper surface waters are tropical year-round and highly stratified during summer months (thermocline occurring at water depths between 30 and 60 m). In winter, surface waters are well mixed with thermoclines occurring at about 120 m depth.
- Surface ocean circulation is strongly influenced by the ITF via the Eastern Gyre. During the summer when the ITF is weaker, south-west winds cause intermittent reversals in currents. These events may be associated with occasional weak, shelf upwellings.
- The seabed in the region consists of sediments that generally become finer with increasing water depth, ranging from sand and gravels on the continental shelf to mud on the slope and abyssal plain. About 60–90% of the sediments in the region are carbonate derived (Brewer et al., 2007). The distribution and resuspension of sediments on the inner shelf is strongly influenced by the strength of tides across the continental shelf as well as episodic cyclones. Further offshore, on the mid to outer shelf and on the slope, sediment movement is primarily influenced by ocean currents and internal tides, the latter causing resuspension and net downslope deposition of sediments.
- The region has high species richness but a relatively low level of endemism, i.e. species particular to the region in comparison to other areas of Australian waters. Furthermore, the majority of the region's species are tropical and are recorded in other areas of the Indian Ocean and Western Pacific Ocean.
- Benthic communities within the region range from nearshore benthic primary producer habitats such as seagrass beds, coral communities and mangrove forests to offshore soft sediment seabed habitats associated with low density sessile and mobile benthos such as sponges, molluscs and echinoids (with noted areas of sponge hotspot diversity).
- Presence of internationally significant migratory routes, resident populations, breeding and/or feeding grounds for a number of EPBC Act listed threatened and migratory marine species, including humpback whales, marine turtles, whale sharks, seabirds and migratory shorebirds.

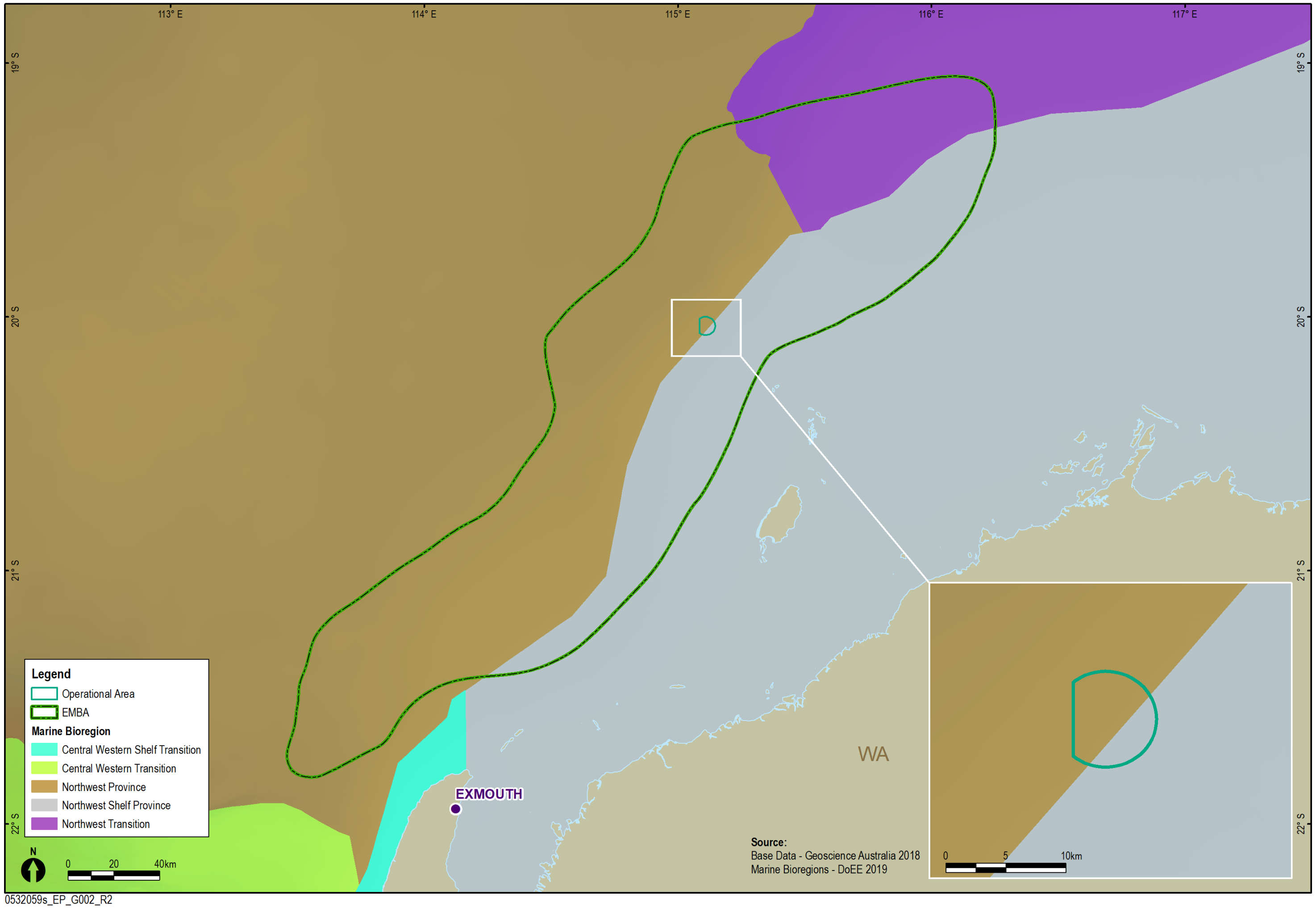


Figure 4-2: North-west Marine Region and the location of the Operational Area

4.4 Physical Environment

4.4.1 Climate and Meteorology

4.4.1.1 Seasonal Patterns

The climate of the NWMR is dry tropical, exhibiting a hot summer season from October to April and a milder winter season between May and September (Figure 4-3) (Bureau of Meteorology (BoM), 2012). There are often distinct transition periods between the summer and winter regimes, which are characterised by periods of relatively low winds (Pearce et al., 2003).

Air temperatures in the region, as measured at the Karratha Aerodrome (approximately 184 km from the Operational Area), indicate maximum average temperatures during summer of 35.9 ºC and minimum temperatures of 15.1 ºC in winter (BoM, 2019).

The region experiences a tropical monsoon climate, with distinct wet (November to April) and dry (May to October) seasons. Rainfall in the region typically occurs during the wet season (summer), with highest falls observed during late summer (BoM, 2019), often associated with the passage of tropical low pressure systems and cyclones (Pearce et al., 2003). Rainfall outside of this period is typically low.

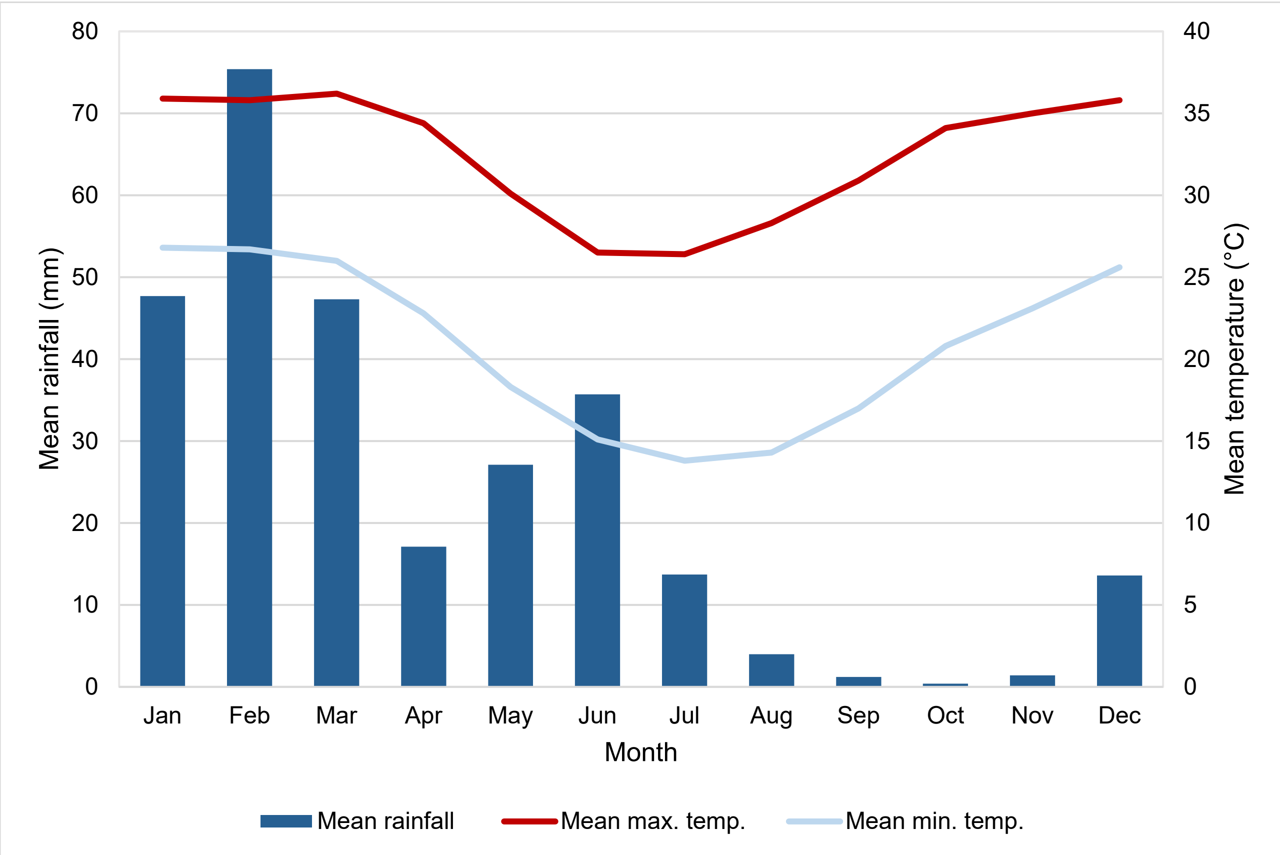


Figure 4-3: Mean monthly maximum temperature, minimum temperature and rainfall from Karratha Aerodrome meteorological station from January 1993 to October 2019 (BoM, 2019)

4.4.1.2 Wind

Winds vary seasonally, with a tendency for winds from the south-west quadrant during summer and the south-east quadrant in winter (Figure 4-4). The summer south-westerly winds are driven by high pressure cells that pass from west to east over the Australian continent. During winter months, the relative position of the high pressure cells moves further north, leading to prevailing south-easterly winds blowing from the mainland (Pearce et al., 2003). Winds typically weaken and are more variable during the transitional period between the summer and winter regimes, generally between April and August (Figure 4-4).

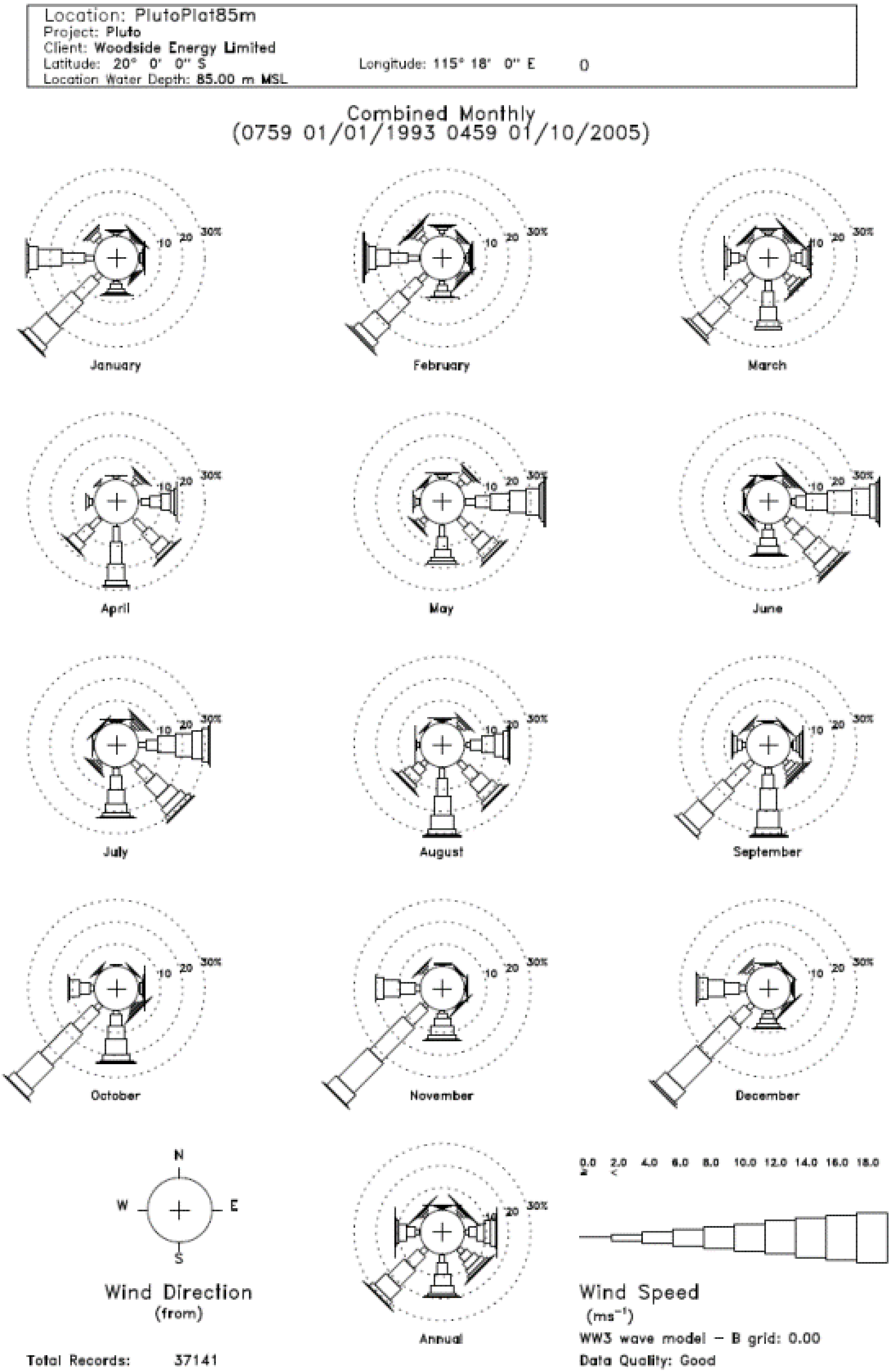


Figure 4-4: Non-cyclonic monthly wind-roses measured at the Pluto Facility location from 1993 to 2005

4.4.1.3 Tropical Cyclones

Tropical cyclones are a relatively frequent event for the region (Figure 4-5), with the Pilbara coast experiencing more cyclonic activity than any other region of the Australian mainland coast (BoM, 2012). Tropical cyclone activity can occur between November and April and is most frequent in the region during January to March, with an annual average of about one storm per month. Cyclones are less frequent in the months of November, December and April but historically the worst storms have occurred in April.

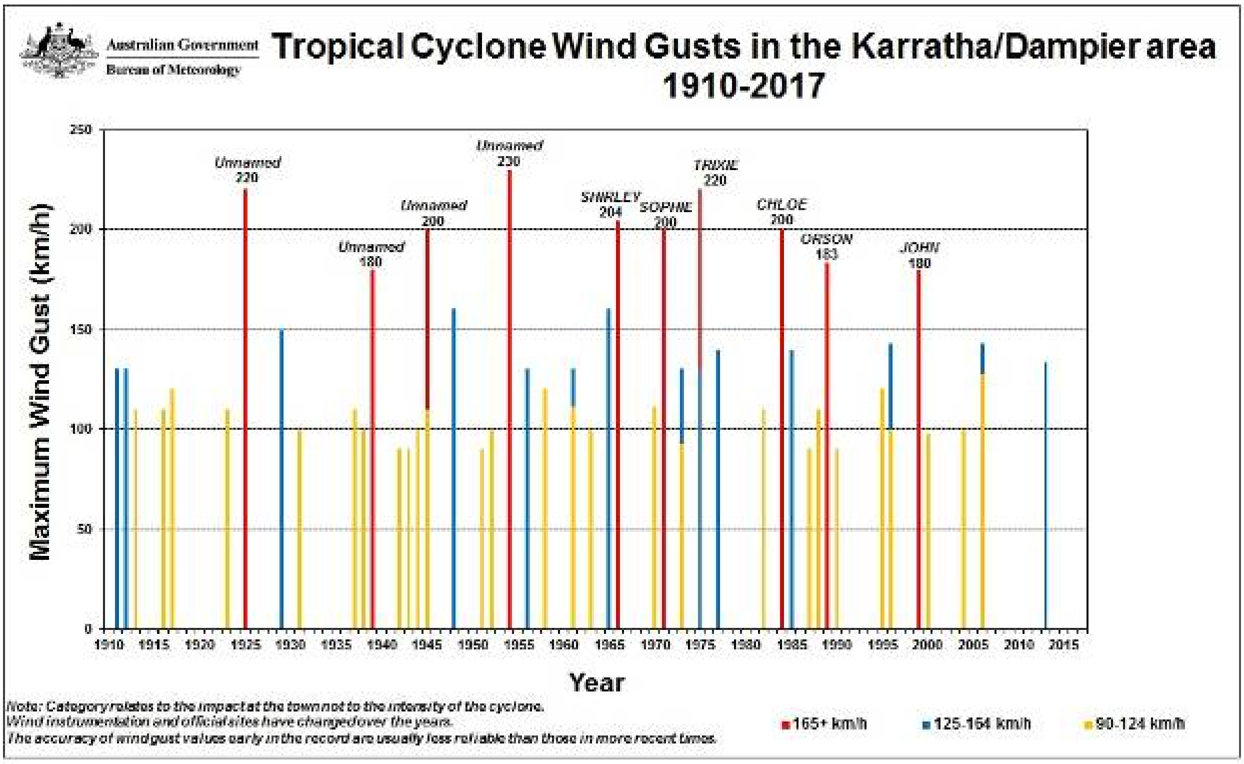


Figure 4-5: Tropical cyclone activity in the Dampier/Karratha region, 1910–2017 (source: BoM, n.d.)

4.4.2 Oceanography

4.4.2.1 Currents and Tides

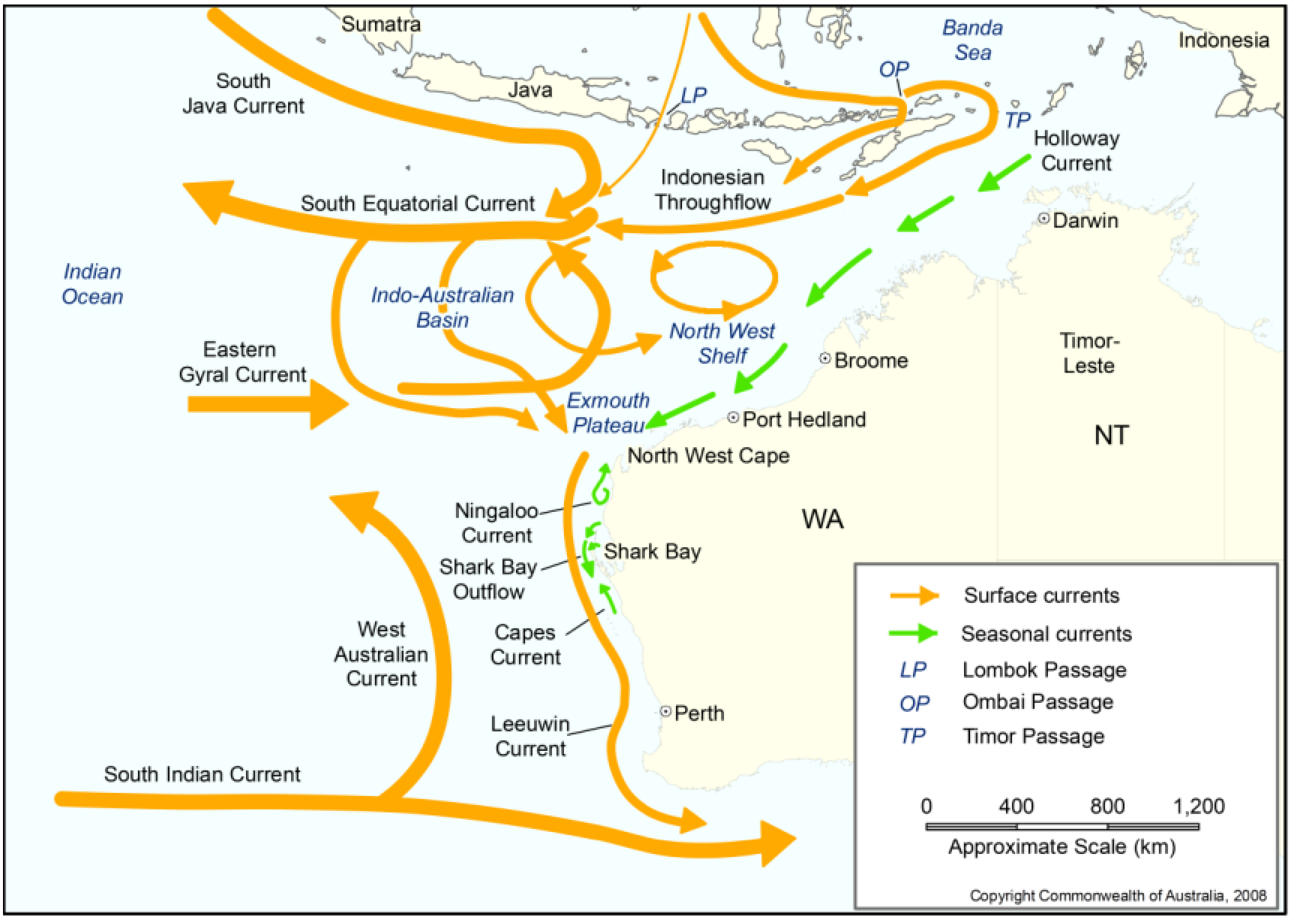
The large-scale ocean circulation of the region is primarily influenced by the ITF (Meyers et al., 1995; Potemra et al., 2003), and the Leeuwin Current (Godfrey & Ridgway, 1985; Holloway & Nye, 1985; Batteen et al., 1992; James et al., 2004) (Figure 4-6). Both of these currents are significant drivers of the region’s ecosystems. The currents are driven by pressure differences between the equator and the higher density cooler and more saline waters of the Southern Ocean, strongly influenced by seasonal change and El Niño and La Niña episodes (Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), 2012a). The ITF and Leeuwin Current are strongest during late summer and winter (Holloway & Nye, 1985; James et al., 2004). Flow reversals to the north-east associated with strong south-westerly winds are typically weak and short lived, but can generate upwelling of cold deep water onto the shelf (Holloway & Nye, 1985; James et al., 2004; Condie et al., 2006).

The Leeuwin Current, which originates in the region, flows southward along the edge of the continental shelf and is primarily a surface flow (up to 300 m deep). It is strongest during winter (Woodside, 2002). The Ningaloo Current flows in the opposite direction to the Leeuwin Current, running northward along the outside of Ningaloo Reef and across the inner shelf from September to mid-April (Figure 4-6). In March, on the termination of the Northwest Monsoon, an ‘extended Leeuwin

Current', currently known as the Holloway Current, develops, flowing to the south-east along the NWS (DSEWPaC, 2012a).

In addition to the synoptic-scale current dynamics, tidally driven currents are a significant component of water movement along the NWS. Wind- -driven currents become dominant during the neap tide (Pearce et al., 2003). In summer, the stratified water column and large tides can generate internal waves over the upper slope of the NWS (Craig, 1988). As these waves pass the shelf break at about 125 m depth, the thermocline may rise and fall by up to 100 m in the water column (Holloway & Nye, 1985; Holloway, 1983). Internal waves of the NWS region are confined to water depths between 70 and 1000 m; the dissipation energy from such waves can enhance mixing in the water column (Holloway et al., 2001).

Tides in the NWS region are semi-diurnal and have a pronounced spring-neap cycle, with tidal currents flooding towards the south-east and ebbing towards the north-west (Pearce et al., 2003). The region exhibits a considerable range in tidal height, from microtidal ranges (<2 m) south-west of Barrow Island to macrotidal (>6 m) north of Broome (Holloway, 1983; Brewer et al., 2007). Storm surges and cyclonic events can also significantly raise sea levels above predicted tidal heights (Pearce et al., 2003).



Source: DEWHA (2008)

Figure 4-6: Generalised schematic of ocean circulation for the wider Western Australian marine region

4.4.2.2 Wave Height

Datawell waverider buoys measured wave height from 1993 to 2005 near the Pluto Platform (23 km from the Operational Area), recording a maximum measured non-cyclonic significant wave height of 6.2 m and a combined non-cyclonic and cyclonic maximum wave height of 11.4 m (Woodside, 2007).

Waves within the NWS reflect the direction of the synoptic winds and flow predominantly from the south-west in the summer and from the east in winter (Pearce et al., 2003). Only 10% of significant wave heights off Dampier exceed 1.2 m, with the average wave height being 0.7 m (Pearce et al., 2003). Storms and cyclones may generate swells up to 8.0 m high (Pearce et al., 2003).

4.4.3 Seawater Characteristics

4.4.3.1 Open Water

Seawater temperature records at the Pluto Platform (23 km from the Operational Area) over a period of 13 months from December 2005 to January 2007 show surface waters reach their maximum average temperatures in March and April (average about 28.5 °C) and are coolest in August, September and October (average about 24.3 °C). These temperatures are also reflected in more recent publicly available data (National Oceanic and Atmospheric Administration (NOAA), 2019a).

The offshore oceanic seawater characteristics of the NWS exhibit seasonal and water depth variation in temperature and salinity, being greatly influenced by major currents in the region (see Section 4.4.2.1). Surface waters are relatively warm year round due to the tropical water supplied by the ITF and the Leeuwin Current, with temperatures reaching 30 °C in summer and dropping to 22 °C in winter (Pearce et al., 2003). Near seabed, temperatures have low interannual variability, changing by ±1.5 °C at depths of 150 m, and become more stable with increasing depth.

During summer, the water column is thermally stratified due to surface heating, with the thermocline occurring between 30 and 60 m water depth (James et al., 2004). Surface waters are relatively well mixed in winter due to a weaker thermal gradient and persistent south-easterly winds promoting mixing, with the thermocline occurring at around 120 m depth (DEWHA, 2008; James et al*.,* 2004).

Variation in surface salinity along the NWS throughout the year is minimal (between 35.2 and 35.7 PSU), with slight increases occurring during the summer months due to intense coastal evaporation (Pearce et al., 2003; James et al., 2004). This small increase in salinity during summer is then countered by the arrival of the lower salinity waters of the Leeuwin Current and ITF in autumn and winter (James et al., 2004). This is also reflected in more recent publicly available data (NOAA, 2019b).

Turbidity is primarily influenced by sediment transported by oceanic swells and primary productivity (Semeniuk et al., 1982; Pearce et al., 2003). Upwelling of nutrient-rich waters may increase phytoplankton productivity in the photic zone, which may increase local turbidity (Semeniuk et al., 1982; Wilson et al., 2003). In nearshore areas, turbidity is highly variable due to storm runoff, wind-generated waves and large tidal ranges (Pearce et al., 2003). Periodic events, such as major sediment transport associated with tropical cyclones, may influence turbidity on a regional scale (Brewer et al., 2007).

Water quality in the NWMR within the EMBA is regulated by the ITF, a low-salinity water mass that plays a key role in initiating the Leeuwin Current (DSEWPaC, 2012a). It brings warm, low-nutrient, low-salinity water from the western Pacific Ocean through the Indonesian archipelago to the Indian Ocean. It is the primary driver of the oceanographic and ecological processes in the region (DEWHA, 2008). South of the NWMR, the Leeuwin Current continues to bring warm, low-nutrient, low-salinity water further south. Eddies formed by the Leeuwin Current transport nutrients and plankton communities offshore (DEWHA, 2008). During summer, the Leeuwin Current typically weakens and the Ningaloo Current develops, facilitating upwellings of cold, nutrient-rich waters up onto the NWS (DSEWPaC, 2012a). Other areas of localised upwelling in the NWMR include the Wallaby Saddle and the northern and southern margins of the Exmouth Plateau, where these seabed topographical features and internal waves force the surrounding deeper, cooler, nutrient-rich waters up into the photic zone (DSEWPaC, 2012a).

4.4.4 Bathymetry and Seabed Habitats

The Operational Area is located in waters of 166–511 m deep at the transition between the continental shelf and continental slope (Figure 4-7). Bathymetry data indicate that the south-west portion of the Operational Area is located on the outer continental shelf and is predominantly flat and featureless. The north-east portion of the Operational Area overlaps with an area of seabed known as the ‘upper slope’ (water depth of 225–500 m) and forms part of the Continental Slope Demersal Fish Communities KEF. Refer to Section 4.7.3 for a detailed description of the Continental Slope Demersal Fish Communities KEF.

Within the EMBA, the bathymetry of the NWMR is characterised by three distinct zones: the middle continental shelf, the outer shelf/continental slope and the abyssal plain. These divisions are made on the basis of water depth and geomorphic features in the region (Heap & Harris, 2008). The middle continental shelf is the area between 30 and 120 m water depth. Several deep-sea geomorphic features in the form of abyssal plains, marginal plateaus and sub-marine canyons provide broad-scale, biologically important seabed habitat in the EMBA. These have been defined as KEFs by the Commonwealth Government, and are described in Section 4.7.3.

Several steps and terraces caused by Holocene sea level changes are present in the NWMR, with the most prominent of these features occurring as an escarpment along the NWS and Sahul Shelf at a depth of 125 m. This escarpment is related to an ancient sub-aerially exposed land surface and coastline (beach and dune deposits), known as the ancient coastline. The Ancient Coastline at 125 m Depth Contour is designated as a KEF and is located 4 km south-east of the Operational Area. A description of the Ancient Coastline KEF is provided in Section 4.7.3. Rankin Bank is the next closest complex bathymetry feature to the Operational Area (about 40 km to the north-east).

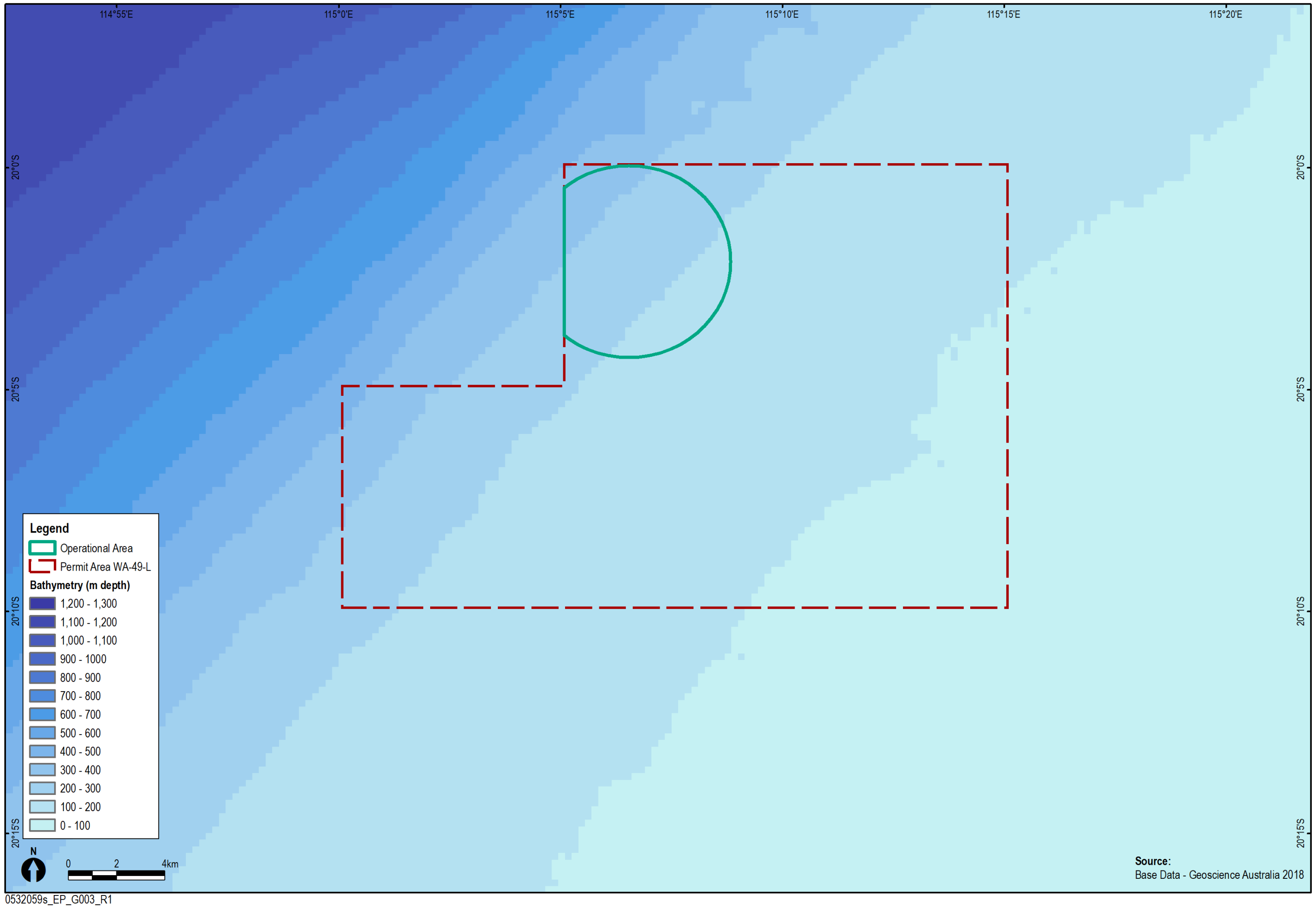


Figure 4-7: Bathymetry of the Operational Area

4.4.4.1 Marine Sediment

Sediments of the NWMR (and within the EMBA) are comprised of bio-clastic, calcareous and organogenic sediments (Baker et al., 2008). On the continental shelf, sediment is primarily sand and gravels, while the slope and deep ocean seabed is primarily mud.

A benthic survey conducted as part of the Julimar Operations EP (directly adjacent to the Operational Area) found that the area is dominated by soft sediment (fine to coarse sands) (Neptune Geomatics, 2010; RPS, 2010a, 2011a), similar to previous surveys within the Northwest Shelf Province and nearby fields at similar water depths (RPS et al., 2004; Chevron 2005, 2010; RPS 2010b, 2011b). Seabed relief in areas of bare sediment consisted mainly of 'small ripples' less than 0.1 m high, which is consistent with tidally-driven bottom currents. Sediments at the nearby Balnaves field, about 4 km south-east of the Operational Area and in 135 m water depth, are fine silt and mud (RPS, 2011b). The north-west portion of the Operational Area that overlaps with the Northwest Province is expected to comprise of a higher percentage of muddy substrates typically found on the upper slope (DEWHA, 2008).

4.4.5 Air Quality

There is a lack of air quality data for the offshore NWS air shed. Studies have been undertaken for the nearshore Pilbara environment to monitor known sources of potential air pollution for locations such as the Burrup Peninsula and Port Hedland, but no monitoring is undertaken offshore.

Due to the extent of the open ocean area and the activities that are currently performed, the ambient air quality in the Operational Area and wider offshore region is considered to be of high quality.

4.5 Biological Environment

4.5.1 Habitats

4.5.1.1 Critical Habitat – EPBC Listed

No Critical Habitats or Threatened Ecological Communities as listed under the EPBC Act are known to occur within the Operational Area or EMBA, as indicated by the EPBC Act Protected Matters Reports produced on 15 November 2019 (Appendix C).

4.5.1.2 Marine Primary Producers

Seabed communities in deeper shelf waters receive insufficient light to sustain ecologically sensitive primary producers such as seagrasses, macroalgae or reef-building corals. Given the depth of water at the Operational Area (about 166–511 m), these benthic primary producer groups will not occur in the area. A number of surveys (Neptune Geomatics, 2010; RPS, 2010a, 2011a) near the Operational Area and in similar water depths have confirmed that these benthic primary producer habitats are not present.

A limited number of benthic primary producer habitats are present in the EMBA and are described in the next sections.

Coral Reef

Coral reef habitats have a high diversity of corals and associated fish and other species of both commercial and conservation importance. Coral reef habitats are an integral part of the marine environment within the NWMR. The nearest coral reef habitat is located at Rankin Bank, about 40 km north-east of the Operational Area. Further information on coral reef habitats at these locations is provided in Section 4.7.1 to Section 4.7.4.

Seagrass Beds/Macroalgae

Seagrass beds and macroalgal habitats represent a food source for many marine species and also provide key habitats and nursery grounds (Department of Fisheries (DoF), 2011b).

Seagrass beds and macroalgal habitats are present in several locations within the Northwest Shelf Province. The nearest seagrass habitats to the Operational Area are located within the Montebello Marine Park (AMP) and may occur within the EMBA. Further information on seagrass and macroalgal habitats in the Montebello AMP is provided in Section 4.7.1 to Section 4.7.4.

Mangroves

The closest mangrove habitats to the Operational Area are located at the Montebello/Barrow/ Lowendal Islands Group, about 52 km to the south-east and outside the EMBA. Mangroves are therefore not considered further in this EP.

4.5.1.3 Other Communities/Habitats

Soft Sediments and Benthic Fauna

Benthic communities associated with the soft sediment seabed habitat within the Operational Area include fauna living within the sediments (infauna) and those living on or above the seabed (sessile and mobile epifauna). These fauna are predominantly mobile burrowing species including molluscs, crustaceans (crabs, shrimps and smaller related species), polychaetes, sipunculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins) and other small animals.

A benthic survey conducted 4 km south-east of the Operational Area as part of the Balnaves Development (within permit area WA-49-L) recorded sparse (less than 5% cover) epibenthic fauna comprising occasional anemones, urchins, sea whips, sea pens, feather stars and glass sponges (RPS, 2011b). Video surveys of the benthic habitats found similar sparse epibenthic communities to those reported in the sampling for the Balnaves Development in proximity to the Operational Area. Infauna were diverse and dominated by polychaete worms and crustaceans (RPS, 2011b). Similarly, at the Pluto Platform (about 23 km from the Operational Area), sampling revealed a sparsely abundant, variable and diverse infauna community dominated by polychaetes, nemerteans, sipunculids and crustaceans (SKM, 2006).

These results support the findings of other NWS sampling programs, which indicate a widespread and well represented infauna assemblage along the continental shelf and upper slopes (Rainer, 1991; Le Provost et al., 2000; Woodside, 2004; Brewer et al., 2007; RPS, 2012a). Additionally, it is expected that these infauna communities will be widely represented within the EMBA.

Small areas of cemented sediments (which can also be described as limestone pavement with a sand veneer) have been recorded during seabed surveys in various locations throughout the NWS (Australian Institute of Marine Science (AIMS), 2014). Such habitat may occur in the Operational Area and could provide habitat for sessile filter feeding communities comprising gorgonians (sea whips and fans) and sponges. These areas support a higher diversity and abundance of epifauna (including mobile invertebrates such as crustacea and echinoderms) and fishes as compared to soft sediment habitats (RPS, 2011a).

Plankton

Phytoplankton within the Operational Area is generally expected to reflect the conditions of the NWMR. Primary productivity of the NWMR appears to be largely driven by offshore influences (Brewer et al., 2007), with periodic upwelling events and cyclonic influences driving coastal productivity with nutrient recycling and advection. There is a tendency for offshore phytoplankton communities in the NWMR to be characterised by smaller taxa (e.g. bacteria), whereas shelf waters are dominated by larger taxa such as diatoms (Hanson et al., 2007).

Zooplankton within the Operational Area may include organisms that complete their lifecycle as plankton (e.g. copepods, euphausiids) as well as larval stages of other taxa such as fishes, corals and molluscs. Peaks in zooplankton such as mass coral spawning events (typically in March and April) (Rosser & Gilmour, 2008; Simpson et al., 1993b) and fish larvae abundance can occur throughout the year.

Pelagic and Demersal Fish Populations

Fish species in the NWMR (including the Operational Area and the EMBA) comprise small and large pelagic fish, as well as demersal species. Small pelagic fish inhabit a range of marine habitats, including inshore and continental shelf waters. They feed on pelagic phytoplankton and zooplankton and represent a food source for a wide variety of predators including large pelagic fish, sharks, seabirds and marine mammals (Mackie et al., 2007). Large pelagic fish in the NWMR include commercially targeted species such as mackerel, wahoo, tuna, swordfish and marlin. Large pelagic fish are typically widespread, found mainly in offshore waters (occasionally on the shelf) and often travel extensively.

Demersal fish live and feed on or near the seabed and are associated with a wide range of habitats in the NWMR including coastal and estuarine ecosystems, macroalgal and seagrass communities, and coral reefs (Hutchins, 2001; Blaber et al., 1985). Demersal fish also include commercially important species such as groper, cod and snapper. Fish species richness has been shown to correlate with habitat complexity, with more complex habitat supporting greater species richness and abundance than bare areas (Gratwicke & Speight, 2005). Studies at Glomar Shoal and Rankin Bank found that species richness and abundance decreased with water depth, with the highest diversity found in water depths less than 40 m (AIMS, 2014). Cemented sediment outcrops that may occur within the Operational Area would provide habitat for sessile filter feeding communities and would likely provide habitat for demersal fish populations.

The Continental Slope Demersal Fish Communities KEF overlaps the north-west portion of the Operational Area and is identified as one of the most diverse slope assemblages in Australian waters (see Section 4.7.3.1). Diversity of demersal fish assemblages on the continental slope between North West Cape and the Montebello Trough is the highest in Australia (>500 species of which 76 are endemic) (DEWHA, 2008). Demersal fish species occupy two distinct demersal community types (biomes) associated with the upper continental slope (water depth of 225–500 m) and the mid continental slope (750–1000 m) rely on bacteria and detritus-based systems comprised of infauna and epifauna, which in turn become prey for a range of teleost fish, molluscs and crustaceans (Brewer et al., 2007). Higher-order consumers may include carnivorous fish, deepwater sharks, large squid and toothed whales (Brewer et al., 2007).

Key demersal fish biodiversity areas are likely to occur in other complex habitats, such as coral reefs, and therefore likely include the Montebello/Barrow/Lowendal Island Group and the Muiron Islands.

4.5.2 Protected Species

The EPBC Act Protected Matters Search Tool was used to identify species listed under the EPBC Act that may occur within the Operational Area and EMBA. The results of the search inform the assessment of planned impacts as well as unplanned events in Section 6 that are confined to the Operational Area. Information about species in the EMBA is included in this section and informs the assessment of unplanned events in Section 6 that are not confined to the Operational Area (i.e. hydrocarbon spills). It should be noted that the EPBC Act Protected Matters Search Tool is a general database that conservatively identifies areas in which protected species have the potential to occur.

A total of 59 EPBC Act listed species were identified as potentially occurring within the Operational Area (Appendix C). Of those listed, 18 are considered threatened marine species (MNES) and 32 are listed migratory species under the EPBC Act (Table 4-3).

A total of 70 EPBC Act listed species were identified as potentially occurring within the EMBA (Appendix C). Of those listed, 22 species within the EMBA are considered threatened marine species (MNES) and 38 are listed migratory species under the EPBC Act (Table 4-3). Two conservation dependent species have also been identified with a potential to occur within the Operational Area and EMBA.

The full list of species identified from the Protected Matters Search is provided in the EPBC Act Protected Matters Search Report (Appendix C).

Table 4-3: Threatened and migratory marine species under the EPBC Act potentially occurring with the Operational Area and EMBA

Species	Common name	Threatened status	Migratory status	Potential occurrence	
				Operational Area	EMBA
Mammals					
Balaenoptera musculus	Blue Whale	Endangered	Migratory	✓	✓
Megaptera novaeangliae	Humpback Whale	Vulnerable	Migratory	✓	✓
Balaenoptera borealis	Sei Whale	Vulnerable	Migratory	✓	✓
Balaenoptera physalus	Fin Whale	Vulnerable	Migratory	✓	✓
Balaenoptera edeni	Bryde’s Whale	N/A	Migratory	✓	✓
Orcinus orca	Killer Whale, Orca	N/A	Migratory	✓	✓
Physeter macrocephalus	Sperm Whale	N/A	Migratory	✓	✓
Tursiops aduncus	Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	N/A	Migratory	✓	✓
Balaena glacialis australis	Southern Right Whale	Endangered	Migratory	x	✓
Balaenoptera bonaerensis	Antarctic Minke Whale	N/A	Migratory	x	✓
Sousa chinensis	Indo-Pacific Humpback Dolphin	N/A	Migratory	x	✓
Reptiles					
Caretta caretta	Loggerhead Turtle	Endangered	Migratory	✓	✓
Chelonia mydas	Green Turtle	Vulnerable	Migratory	✓	✓
Dermochelys coriacea	Leatherback Turtle	Endangered	Migratory	✓	✓
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable	Migratory	✓	✓
Natator depressus	Flatback Turtle	Vulnerable	Migratory	✓	✓
Aipysurus apraefrontalis	Short-nosed Seasnake	Critically Endangered	N/A	x	✓
Sharks, Fish and Rays					
Rhincodon typus	Whale Shark	Vulnerable	Migratory	✓	✓

Species	Common name	Threatened status	Migratory status	Potential occurrence	
				Operational Area	EMBA
Carcharius taurus	Grey Nurse Shark	Vulnerable	N/A	✓	✓
Carcharodon carcharias	Great White Shark	Vulnerable	Migratory	✓	✓
Pristis zijsron	Green Sawfish	Vulnerable	Migratory	✓	✓
Anoxypristis cuspidata	Narrow Sawfish	N/A	Migratory	✓	✓
Isurus oxyrinchus	Shortfin Mako	N/A	Migratory	✓	✓
Isurus paucus	Longfin Mako	N/A	Migratory	✓	✓
Manta birostris	Giant Manta Ray	N/A	Migratory	✓	✓
Manta alfredi	Reef Manta Ray	N/A	Migratory	✓	✓
Pristis clavata	Dwarf Sawfish	Vulnerable	Migratory	x	✓
Sphyrna lewini	Scalloped Hammerhead	Conservation Dependent	N/A	✓	✓
Thunnus maccoyii	Southern Bluefin Tuna	Conservation Dependent	N/A	✓	✓
Birds					
Macronectes giganteus	Southern Giant-Petrel	Endangered	Migratory	✓	✓
Calidris canutus	Red Knot	Endangered	Migratory	✓	✓
Numenius madagascariensis	Eastern Curlew	Critically Endangered	Migratory	✓	✓
Sternula nereis	Australian Fairy Tern	Vulnerable	N/A	✓	✓
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	Migratory	✓	✓
Anous stolidus	Common Noddy	N/A	Migratory	✓	✓
Calonectris leucomelas	Streaked Shearwater	N/A	Migratory	✓	✓
Fregata ariel	Lesser Frigatebird	N/A	Migratory	✓	✓
Calidris melanotos	Pectoral Sandpiper	N/A	Migratory	✓	✓

Species	Common name	Threatened status	Migratory status	Potential occurrence	
				Operational Area	EMBA
Pandion haliaetus	Osprey	N/A	Migratory	✓	✓
Actitis hypoleucos	Common Sandpiper	N/A	Migratory	✓	✓
Calidris acuminata	Sharp-tailed Sandpiper	N/A	Migratory	✓	✓
Pterodroma mollis	Soft-plumaged Petrel	Vulnerable	N/A	x	✓
Ardenna carneipes	Flesh-footed Shearwater	N/A	Migratory	x	✓
Fregata minor	Great Frigatebird	N/A	Migratory	x	✓

4.5.2.1 Listed Threatened Species Recovery Plans and Conservation Advice

The requirements of the species recovery plans and conservation advices (Table 4-4) will be considered to identify any requirements that may apply to the risk assessment (Section 6). Recovery plans are enacted under the EPBC Act and remain in force until the species is removed from the threatened list. Conservation advice provides guidance on immediate recovery and threat abatement activities that can be performed to facilitate the conservation of a listed species or ecological community.

Table 4-4 outlines the recovery plans and conservation advices relevant to those species identified by the EPBC Protected Matters search (Appendix C) as potentially occurring within or using habitat in the Operational Area and EMBA, and summarises the key threats to those species, as described in relevant recovery plans and conservation advices.

Table 4-4: Conservation advice for EPBC Act listed species considered during environmental risk assessment as relevant to the Operational Area and EMBA

Species/sensitivity	Recovery plan/conservation advice (date issued)	Key threats identified in the recovery plan/ conservation advice	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 (DoEE, 2018)	Marine debris	Identifies offshore vessels as a potential source of marine debris.
Marine mammals			
Sei whale	Conservation advice *Balaenoptera borealis* sei whale (Threatened Species Scientific Committee, 2015a)	Noise interference	Assess and manage acoustic disturbance.
		Vessel disturbance	Assess and manage physical disturbance and development activities.
Blue whale	Conservation management plan for the blue whale: *A recovery plan under the Environment Protection and Biodiversity Conservation Act 1999* 2015-2025 (Commonwealth of Australia, 2015a)	Noise interference	Assess and address anthropogenic noise.
		Vessel disturbance	Minimise vessel collision.
Fin whale	Conservation advice *Balaenoptera physalus* fin whale (Threatened Species Scientific Committee, 2015b)	Noise interference	Assess and address anthropogenic noise.
		Vessel disturbance	Develop a national vessel strike strategy that investigates the risk of vessel strikes on fin whales and also identifies potential mitigation measures. Ensure all vessel strike incidents are reported in the National Vessel Strike Database.
Humpback whale	Approved conservation advice for *Megaptera novaeangliae*	Noise interference	Assess and address anthropogenic noise.

Species/sensitivity	Recovery plan/conservation advice (date issued)	Key threats identified in the recovery plan/ conservation advice	Relevant conservation actions
	(humpback whale) (Threatened Species Scientific Committee, 2015c)	Vessel disturbance	Ensure the risk of vessel strike on humpback whales is considered when assessing actions that increase vessel traffic in areas where humpback whales occur and, if required, appropriate mitigation measures are implemented to reduce the risk of vessel strike.
Southern right whale	Conservation management plan for the southern right whale: a recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2011–2021 (DSEWPaC, 2012b)	Noise interference	Assess and address anthropogenic noise: shipping, industrial and seismic surveys.
		Vessel disturbance	Address vessel collisions.
Reptiles			
Loggerhead turtle, hawksbill turtle, green turtle, and flatback turtle	Recovery plan for marine turtles in Australia (Commonwealth of Australia, 2017)	Vessel disturbance	No specific management actions in relation to vessels prescribed in the plan; vessel interactions identified as a threat.
		Light pollution	Minimise light pollution. Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution.
		Acute chemical discharge (oil pollution)	Ensure spill risk strategies and response programs include management for turtles and their habitats.
Leatherback turtle	Approved conservation advice for *Dermochelys coriacea* (leatherback turtle) (DEWHA, 2008b)	Vessel disturbance	No explicit relevant management actions; vessel strikes identified as a threat.
	Recovery plan for marine turtles in Australia (Commonwealth of Australia, 2017)		
Short-nosed seasnake	Approved conservation advice for *Aipysurus apraefrontalis* (short-nosed sea snake) (DSEWPaC, 2011a)	Habitat degradation/ modification	None applicable.
Sharks, fish and rays			
Great white shark	Recovery plan for the white shark (*Carcharodon carcharias*) (DSEWPaC, 2013a)	No additional threats identified (ex. marine debris)	None applicable.
Green sawfish	Approved conservation advice for green sawfish (DEWHA, 2008c)	Habitat degradation/ modification	No explicit relevant management actions; habitat loss, disturbance and modification identified as threats.

Species/sensitivity	Recovery plan/conservation advice (date issued)	Key threats identified in the recovery plan/ conservation advice	Relevant conservation actions
	Sawfish and river shark multispecies recovery plan (DoE, 2015a)		Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks.
Dwarf sawfish	Approved conservation advice for *Pristis clavata* (dwarf sawfish) (DEWHA, 2009a)	Habitat degradation/ modification	No explicit relevant management actions; habitat loss, disturbance and modification identified as threats.
	Sawfish and river shark multispecies recovery plan (DoE, 2015a)		Identify risks to important sawfish and river shark habitat and measures needed to reduce those risks.
Whale shark	Conservation advice *Rhincodon typus* whale shark (Threatened Species Scientific Committee, 2015d)	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 Western Australian coastline along the 200 m isobath.
	Whale shark (*Rhincodon typus*) recovery plan 2005-2010[4] (Department of Environment and Heritage (DEH), 2005a)	Habitat degradation/ modification	No explicit relevant management actions; seasonal aggregations of Ningaloo recognised as important habitat.
Grey nurse shark (west coast population)	Recovery plan for the grey nurse shark (*Carcharias taurus*) (DoEE, 2014a)	No additional threats identified (ex. marine debris)	None applicable.
Seabirds			
Red knot	Conservation advice *Calidris canutus* red knot (Threatened Species Scientific Committee, 2016a)	Habitat degradation/ modification	No explicit relevant management actions; oil pollution recognised as a threat.
Eastern curlew	Conservation advice *Numenius madagascariensis* eastern curlew (DoE, 2015c)	Habitat degradation/ modification (oil pollution)	No explicit relevant management actions; oil pollutions recognised as a threat.
Curlew sandpiper	Conservation advice *Calidris ferruginea* curlew sandpiper (DoE, 2015b)	Habitat degradation/ modification (oil pollution)	No explicit relevant management actions; oil pollutions recognised as a threat.
Soft-plumaged petrel	Conservation advice *Pterodroma mollis* soft-plumage petrel (Threatened Species Scientific Committee, 2015e)	Habitat degradation and modifications	No explicit relevant management actions.

[4] While the Whale shark (*Rhincodon typus*) recovery plan ceased to be in effect on 1 October 2015, the conservation advice in this plan was considered to inform the context of the environmental risk assessment for the Petroleum Activities Program.

Species/sensitivity	Recovery plan/conservation advice (date issued)	Key threats identified in the recovery plan/ conservation advice	Relevant conservation actions
Australian fairy tern	Conservation advice for *Sterna nereis* (fairy tern) (DSEWPaC, 2011c)	Habitat degradation/ modification (oil pollution)	Ensure appropriate oil-spill contingency plans are in place for the subspecies' breeding sites which are vulnerable to oil spills.
Common sandpiper, red knot, pectoral sandpiper, sharp-tailed sandpiper, bar-tailed godwit, oriental pratincole, oriental plover, common greenshank	Wildlife conservation plan for migratory shorebirds (Commonwealth of Australia, 2015b)	Habitat degradation/ modification (oil pollution)	No explicit relevant management actions; oil spills recognised as a threat.

4.5.2.2 Habitat Critical to the Survival of a Species

In accordance with the EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance, an action is deemed to have a significant impact if there is a real chance or possibility that it will adversely affect habitat critical to the survival of a species.

Habitat critical to the survival of a species for marine turtles has been identified as nesting and internesting habitat for each genetic stock, based on a set criterion outlined in the Recovery Plan for Marine Turtles in Australia 2017 – 2027 (Commonwealth of Australia, 2017).

The Operational Area and EMBA only overlaps with habitat critical to the survival of a species for flatback turtles (as described below in Table 4-6).

4.5.2.3 Biologically Important Areas

A review of the National Conservation Values Atlas (NCVA) identified that the following BIAs overlap spatially with the Operational Area:

- Flatback turtle internesting buffer zone, maximum 80 km zone from the nearest foraging, mating and nesting sites for flatback turtles on Barrow, the Montebello and Lowendal Islands during summer (peak period in December and January) (Figure 4-10).
- Whale shark foraging northward from the Ningaloo Marine Park along the 200 m isobath (July–November) (Figure 4-11).
- Pygmy blue whale migration corridor extending northward form the Perth canyon towards Indonesia (Figure 4-8). The northward migration occurs past Exmouth from April to August and the southern migration occurs from October to late January.
- Wedge-tailed shearwater foraging around the Montebello and Lowendal Islands, present as a breeding visitor arriving in mid-August and leaving in April (Figure 4-12).

BIAs not within the Operational Area but within the EMBA include:

- Humpback whale migration corridor (North and South), located 28 km south-east of the Operational Area.
- Flatback turtle internesting buffer around the Pilbara Southern Island Group, located 56 km south-west of the Operational Area.
- Wedge-tailed shearwater breeding (Pilbara South Island Group).

4.5.2.4 Seasonal Sensitivities of Protected Species

Periods of the year coinciding with key environmental sensitivities in and around the Operational Area, including EPBC Act listed threatened and/or migratory species potentially occurring within the Operational Area, are presented in Table 4-5. These relate to breeding, foraging or migration of the indicated fauna.

Species that were listed in the EPBC Act Protected Matters Search but do not have defined seasonal sensitivities in the region, or seasonal sensitivities are poorly defined, are not included in the Table 4-5.

Table 4-5: Key environmental sensitivities and timings for fauna (indicative). Migratory whale periods are specific to the NWS Region based on scientific literature. Timing will vary with geographic location along the WA coast.

Species	January	February	March	April	May	June	July	August	September	October	November	December
Blue whale – northern migration (Exmouth, Montebello, Scott Reef)[1]												
Blue whale – southern migration (Exmouth, Montebello, Scott Reef)[2]												
Humpback whale – northern migration (Jurien Bay to Montebello)[3]												

Species	January	February	March	April	May	June	July	August	September	October	November	December
Humpback whale – southern migration (Jurien Bay to Montebello)[4]												
Green turtle – various nesting areas[5]												
Flatback turtle – various nesting areas[6]												
Loggerhead turtle – various nesting areas[6]												
Hawksbill turtles – various nesting areas[6,7]												
Manta rays – presence/ aggregation/breeding (Ningaloo)[8]												
Whale shark* – foraging/ aggregation near Ningaloo[9]												
Wedge-tailed shearwater – various breeding sites[10]												
Osprey – breeding (Ningaloo)[10]												

	Species likely to be present in the region
	Peak period. Presence of animals reliable and predictable each year

References for species seasonal sensitivities:

1. DoE, 2016; McCauley & Jenner, 2010; McCauley & Duncan, 2011
2. DoE, 2016; McCauley & Jenner, 2010
3. Department of Conservation and Land Management (CALM), 2005; Environment Australia, 2002; Jenner et al., 2001a; McCauley & Jenner, 2001
4. McCauley & Jenner, 2001
5. CALM, 2005; Department of Environmental Protection, 2001; DSEWPaC, 2012a; Environment Australia, 2002; Limpus and Chatto, 2004
6. DoEE, 2017; Chevron Australia Pty Ltd, 2015;CALM, 2005; DSEWPaC, 2012a, 2012c
7. Chevron Australia Pty Ltd, 2015; DSEWPaC, 2012c
8. CALM, 2005; DSEWPaC, 2012a; Environment Australia, 2002; Sleeman et al., 2010
9. Environment Australia, 2002
10. DSEWPaC, 2012c; Environment Australia, 2002.

** Periods of sensitivity include whale shark foraging off Ningaloo coast and foraging northward from the Ningaloo Marine Park along the 200 m isobath.*

4.5.2.5 Marine Mammals

Cetaceans – Migratory Whales

<u>*Blue Whale*</u>

There are two recognised subspecies of blue whale in the Southern Hemisphere, which are both recorded in Australian waters. These are the southern (or 'true') blue whale (*Balaenoptera musculus intermedia*) and the 'pygmy' blue whale (*Balaenoptera musculus brevicauda*) (DoE, 2016a). In general, southern blue whales occur in waters south of 60°S and pygmy blue whales occur in waters north of 55°S (i.e. not in the Antarctic) (Department of Environment and Heritage (DEH), 2005b). On this basis, nearly all blue whales sighted in the NWS Region are likely to be pygmy blue whales. The 2015 Conservation Management Plan for the Blue Whale (Commonwealth of Australia, 2015a) has delineated the distribution area of blue whales in Australian waters and identified a number of BIAs for WA waters (migratory corridor and foraging areas).

Pygmy blue whale migration is thought to follow deep oceanic routes (DEWHA, 2008). In the NWMR and within the EMBA, pygmy blue whales migrate along the 500–1000 m depth contour on the edge of the slope, where they are likely to feed opportunistically on ephemeral krill aggregations (DEWHA, 2008). This area has been defined by the DoEE as a BIA for the species and spatially overlaps the Operational Area (Figure 4-8). Sea noise loggers at various locations along the WA coast have detected an annual northbound migration past Exmouth and the Montebello Islands between April and August, and southbound migration from October to the end of December, peaking in late November to early December for north of the Montebello Islands (McCauley & Jenner, 2010; McCauley & Duncan, 2011, Double et al., 2012).

Recent satellite tagging (2009–2012) confirmed the general distribution of pygmy blue whales was offshore in water depths over 200 m and commonly over 1000 m (Double et al., 2012) (Figure 4-8), generally west of the Operational Area within the NWMR and EMBA. This data was revisited in 2014 and showed that whales tagged in WA during March and April migrated northwards post tag deployment. The tagged whales travelled relatively near to the Australian coastline (100.0 ± 1.7 km) in water depths of 1369.5 ± 47.4 m, until reaching the North West Cape, after which they travelled offshore (238.0 ± 13.9 km) into progressively deeper water (2617.0 ± 143.5 m). Whales reached the northern terminus of their migration and potential breeding grounds in Indonesian waters by June (Double et al., 2014). Although the BIA for this species has been defined as the migration corridor centred between the 500 m and 1000 m depth contours, this data suggests individuals transit the deeper waters to the west of the Operational Area between mid-April to early August (Figure 4-8) during the northern migration.

The Operational Area overlaps with a small portion of the pygmy blue whale migration BIA. A possible foraging area is also located within the EMBA (Figure 4-8). It is therefore expected that individuals may transit the Operational Area during their northbound/southbound migration.

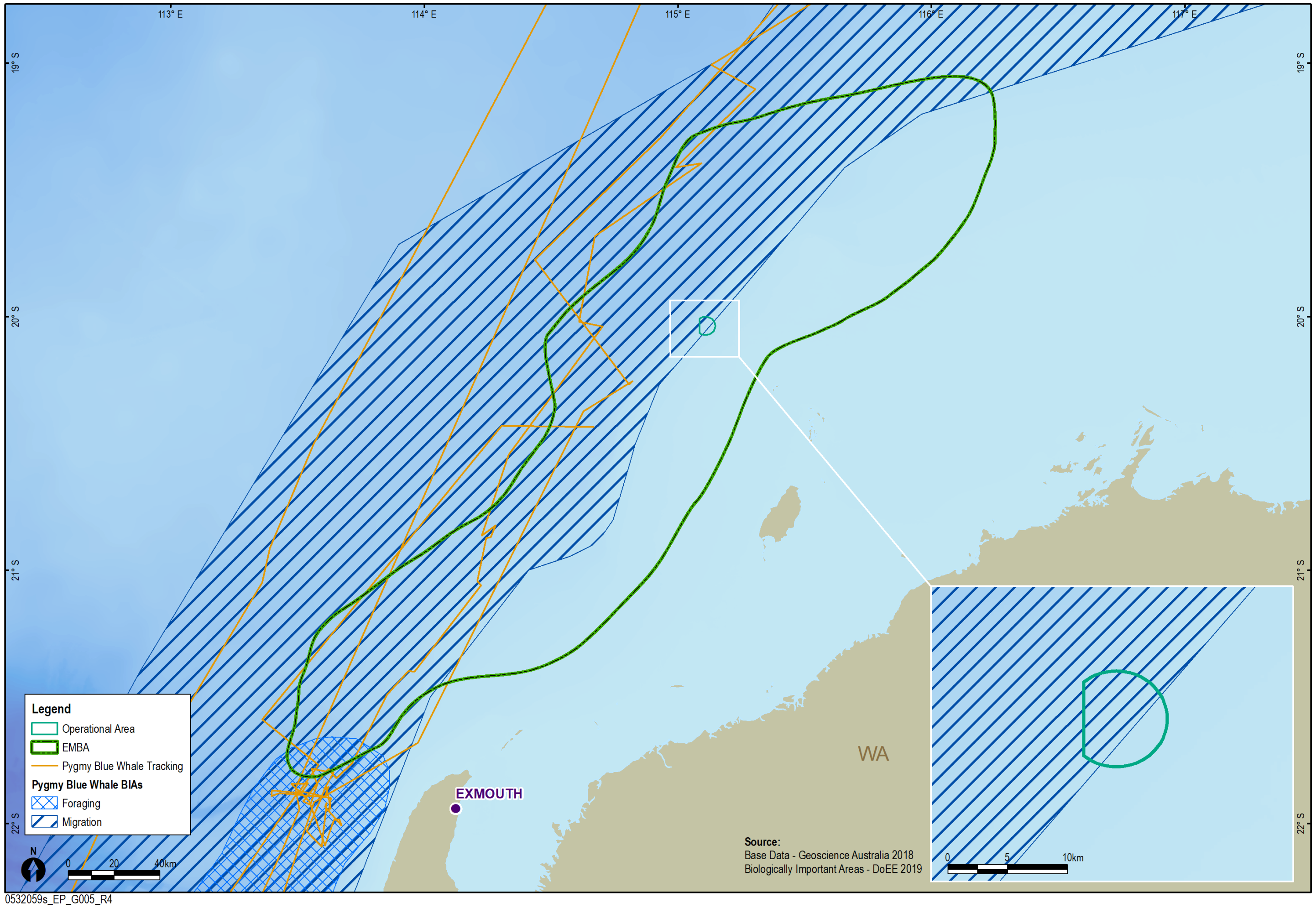


Figure 4-8: Pygmy blue whale migration BIA, possible foraging area and satellite tracking, illustrating migration route

Humpback Whale

The humpback whale migrates along the WA coastline annually as this EPBC Act listed Vulnerable and Migratory marine species completes its seasonal northern and southern migration to and from high latitude feeding grounds to low latitude breeding and calving areas (Commonwealth of Australia, 2015b). Humpback whales travel to and from the southern Kimberley to the northern end of Camden Sound (the main breeding and calving area) in the winter and spring months (Jenner et al., 2001; Commonwealth of Australia, 2015a), after feeding in Antarctic waters during the summer months (Bannister & Hedley, 2001). The Commonwealth of Australia's Conservation Advice for humpback whales (October 2015), identifies the humpback whale's distribution on the west and east coasts of Australia. Calving occurs at the northern extent of the migration corridor (outside of the EMBA for the Petroleum Activities Program). The DoEE has defined the migration corridor (both north and south bound) as a BIA for humpback whales. The BIA is located about 25 km south east of the Operational Area and within the EMBA (Figure 4-9).

Woodside has conducted marine megafauna aerial surveys that have confirmed that the temporal distribution of migrating humpback whales off the North West Cape, in the EMBA, has remained consistent since baseline surveys were first conducted in 2000 to 2001 (RPS, 2010a). The majority of the whales occurred in depths less than 500 m, with the greatest density of whales concentrated in water depths of 200–300 m. Only small numbers of whales were observed to occur in the deeper offshore waters. Current population growth for the humpback whale population that migrates along the WA coast is estimated to be between 9.7 and 13% per annum (Threatened Species Scientific Committee, 2015c). Using the Salago-Kent et al., (2012) estimate in 2008 of 26,100 individuals and an annual population growth rate of 10%, 2019 population estimates could be greater than 75,000 individuals."

From the North West Cape, northbound humpback whales travel along the edge of the continental shelf passing to the west of the Muiron, Barrow and Montebello Islands. The southern migratory route follows a relatively narrow track between the Dampier Archipelago and Montebello Islands, south of the Operational Area (Figure 4-9).

The southbound migration of cow/calf pairs is generally during October (extending into November and December). The peak of the northward migration within/near the Operational Area is during July, while the southern migration peak is late August/early September.

Given this data and the location of the Operational Area in relation to the known humpback migration route (Figure 4-9), it is considered that humpback whales may transit within the Operational Area between June and October, during both their northern and southern migrations. The Operational Area is not located in or adjacent to any known critical habitat areas for this protected migratory whale species (e.g. feeding, breeding or calving). Observed whales are most likely to be transiting between the known aggregation areas of Camden Sound (about 1015 km north-east) and Exmouth Gulf (about 211 km south-west), rather than feeding, resting or breeding.

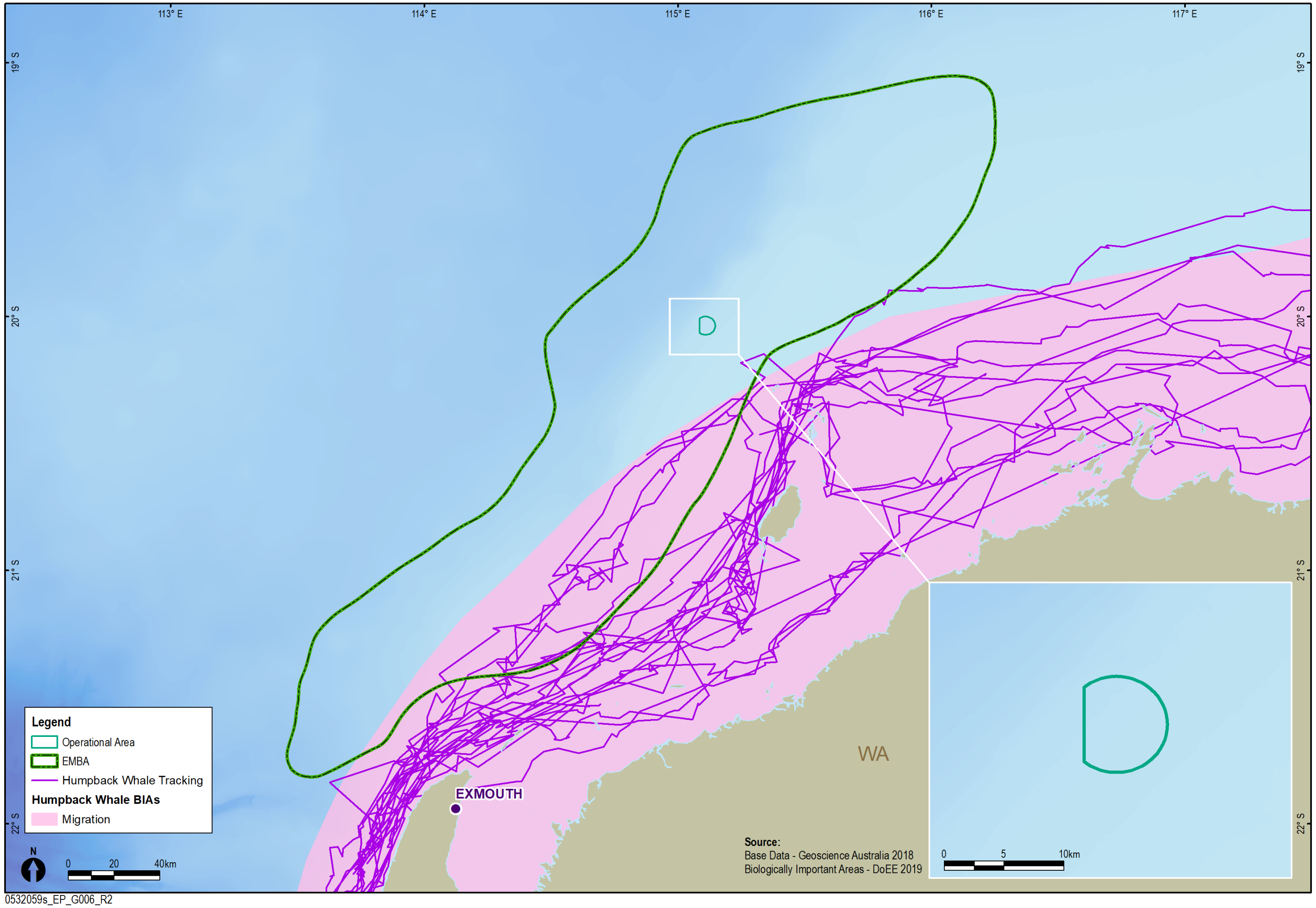


Figure 4-9: Humpback whale migration BIA and satellite tracking, illustrating migration route

Bryde's Whale

The Bryde’s whale occurs in tropical and temperate waters off all Australian states (Bannister et al., 1996). Bryde’s whales occur in both oceanic and inshore waters, with the only key localities recognised in WA being in the Abrolhos Islands and north of Shark Bay (Bannister et al., 1996). Two forms are recognised: inshore and offshore Bryde’s whales. It appears that the offshore form may migrate seasonally, heading towards warmer tropical waters during the winter; however, information on migration is not well known.

Within the EMBA, Bryde’s whales tend to transit seasonally through a broad area of the continental shelf (McCauley & Duncan, 2011; RPS, 2012b). This species has been detected within the Northwest Shelf Province from mid-December to mid-June, peaking in late February to midApril (RPS, 2012b). Given the distribution of Bryde’s- whales, the Operational Area is unlikely to represent an important habitat for this species so their presence is considered unlikely and limited to a few individuals infrequently transiting the area.

Sperm Whale

The sperm whale has a worldwide distribution in deep waters (greater than 200 m) off continental shelves and sometimes near shelf edges, averaging 20–30 nautical miles offshore (Bannister et al., 1996).

Within the EMBA, sperm whales have been recorded in deep water off North West Cape (Jenner et al., 2010; RPS, 2010c; Woodside, 2010) and appear to occasionally venture into shallower waters in other areas (RPS, 2010c). The only key locality recognised in WA waters for sperm whales is along the southern coastline between Cape Leeuwin and Esperance (Bannister et al., 1996), outside of the EMBA for the Petroleum Activities Program.

There is limited information about sperm whale distribution in Australian waters; however, they are usually found in deep offshore waters, with more dense populations close to continental shelves and canyons (DoEE, 2019). The species may occur in severely fragmented populations. Key localities in Australia include; the southern coastline between Cape Leeuwin and Esperance, WA (Bannister et al., 1996); south-west of Kangaroo Island, SA; deep waters off the Tasmanian west and south coasts; southern NSW; and deep waters off Stradbroke Island, Qld (Ceccarelli et al., 2011). There are no known BIAs for sperm whales in the NWMR. In the open ocean, there is a generalised movement of sperm whales southwards in summer, and corresponding movement northwards in winter, particularly for males (DoEE, 2019). Detailed information about the distribution and migration patterns of sperm whales off the WA coast is not available.

Females with young may reside within the NWMR all year round, and males may migrate through the region, and the species may be associated with canyon habitats (Ceccarelli et al., 2011). Sperm whales have been recorded in deep waters off North West Cape (Jenner et al., 2010) and appear to occasionally venture into shallower waters in other areas. Twenty-three sightings of sperm whales (variable pod sizes, ranging from one to six animals) were recorded by marine mammal observers (MMOs) during the North West Cape MC3D marine seismic survey conducted between December 2016 and April 2017. These animals were observed in deep, continental slope waters of the Montebello Saddle (maximum distance of about 90 km from North West Cape), and the waters overlying the Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula KEF.

Given the wide distribution of sperm whales and their preference for deeper oceanic waters, the Operational Area is unlikely to represent an important habitat for this species. Their presence is likely to be a rare occurrence and limited to a few individuals infrequently transiting the area.

Sei Whale

The sei whale is a baleen whale which, like many species of baleen whales, was significantly reduced in numbers by commercial whaling operations. The species has a worldwide oceanic distribution, and is expected to seasonally migrate between low latitude wintering areas and high latitude summer feeding grounds (Bannister et al., 1996; Prieto et al., 2012). Sei whales have been infrequently recorded in Australian waters (Bannister et al., 1996), which could be due to the similarity in appearance of sei whales and Bryde's whales leading to incorrect recordings.

There are no known mating or calving areas, or other BIAs for sei whales in Australian waters (DoE, 2016a). The species prefers deep waters, and typically occurs in oceanic basins and continental slopes (Prieto et al., 2012); records of the species occurring on the continental shelf (<200 m water depth) are uncommon in Australian waters (Bannister et al., 1996). Given the Operational Area is located in deeper waters on the continental shelf and continental slope, sei whales may infrequently occur within the Operational Area, mainly during winter months when the species may move away from Antarctic feeding areas.

Fin Whale

The fin whale is a large baleen whale with a cosmopolitan distribution in all ocean basins between 20 and 75°S (DEH, 2005b). The global population of fin whales was reduced significantly by commercial whaling, with the species being targeted due to its large size and broad distribution. Like other baleen whales, fin whales migrate annually between high latitude summer feeding grounds and lower latitude over-wintering areas (Bannister et al., 1996).

Fin whales are thought to follow oceanic migration paths, and are uncommonly encountered in coastal or continental shelf waters. The Australian Antarctic waters are important feeding grounds for fin whales but there are no known mating or calving areas in Australian waters (Morrice et al., 2004). There are no known BIAs for fin whales in the NWMR. As such, the species is likely to infrequently occur within the Operational Area, mainly during winter months when the species may move away from Antarctic feeding areas.

Antarctic Minke Whale

Antarctic minke whales were identified as occurring within the EMBA, but not within the Operational Area. The Antarctic minke whale is distributed worldwide and has been recorded off all Australian states, feeding in cold waters and migrating to warmer waters to breed. It is thought that the Antarctic minke whale migrates up the WA coast to about 20°S to feed and possibly breed (Bannister et al., 1996). However, detailed information on timing and location of migrations and breeding grounds is not well known. Given the wide distribution of Antarctic minke whale, the Operational Area is unlikely to represent an important habitat for this species. Their presence is likely to be a remote occurrence within the EMBA, limited to a few individuals infrequently transiting the area.

Southern Right Whale

Southern right whales were identified as occurring within the EMBA, not within the Operational Area. The southern right whale occurs primarily in waters between about 20°S and 60°S and moves from high latitude feeding grounds in summer to warmer, low latitude, coastal locations in winter (Bannister et al., 1996). Southern right whales aggregate in calving areas along the south coast of WA, such as Doubtful Island Bay, east of Israelite Bay and to a lesser extent Twilight Cove (DoE, 2016). During the calving season, between May and November, female southern right whales that are either pregnant or with calf can be in shallow protected waters along the entire southern Western Australian coast and west up to about Two Rocks, north of Perth. Sightings in more northern waters are relatively rare; however, they have been recorded as far north as Exmouth (Bannister et al., 1996). Southern right whales are therefore unlikely to occur within the EMBA.

Cetaceans – Toothed Whales and Dolphins

Killer Whale

The killer whale has a widespread distribution from polar to equatorial regions of all oceans and has been recorded off all states of Australia (Bannister et al., 1996). Killer whales appear to be more common in cold, deep waters; however, they have been observed along the continental slope and shelf (Bannister et al., 1996), as well as in shallow coastal areas of WA (RPS, 2010c). Anecdotal evidence suggests killer whales may feed on dugongs in Shark Bay but there are no recognised key localities or important habitats for killer whales within the Operational Area or EMBA.

Given the wide distribution of killer whales and their preference for colder waters, the Operational Area is unlikely to represent an important habitat for this species. Their presence is likely to be a rare occurrence and limited to a few individuals infrequently transiting the area.

Spotted Bottlenose Dolphin (Arafura/Timor Sea Populations)

The spotted bottlenose dolphin is generally considered to be a warm water subspecies of the common bottlenose dolphin. Distribution is primarily in inshore waters, often in depths of less than 10 m (Bannister et al., 1996). They are known to occur from Shark Bay, north to the western edge of the Gulf of Carpentaria. Given the distribution of spotted bottlenose dolphins and their preference for shallow coastal waters, the Operational Area is unlikely to represent an important habitat for this species. Their presence is likely to be a rare occurrence and limited to infrequent transiting of the area. The spotted bottlenose dolphin is likely to be present in nearshore and coastal waters, within the EMBA.

Indo-Pacific Humpback Dolphin

The Indo-Pacific humpback dolphin is not expected to occur in the Operational Area based on an EPBC Act Protected Matters search, but may be present in the EMBA. It is now recognised as two distinct species; the Indo-Pacific humpback dolphin (*Sousa chinensis*) and the Australian humpback dolphin (*S. sahulensis*) (Jefferson & Rosenbaum, 2014). Although the EPBC Act Protected Matters Search Tool lists the Indo-Pacific humpback dolphin (*S. chinensis*), which is found in waters around India, China and south-east Asia, this EP will herein refer to the Australian humpback dolphin (*S. sahulensis*) that is known to occur in waters of the NWS and Sahul Shelf from northern Australia to New Guinea. Distribution of the humpback dolphin in Australia is linked to the warm eastern boundary current, with resident groups within Ningaloo Reef (Bannister et al*.,* 1996). Humpback dolphins inhabit shallow coastal, estuarine habitats in tropical and subtropical regions, generally in depths of less than 20 m (Corkeron et al., 1997; Jefferson, 2000; Jefferson & Rosenbaum, 2014). Given their preference for shallow coastal habitats, the Australian humpback dolphin may occur in shallower waters at the south-east extent of the EMBA.

4.5.2.6 Marine Reptiles

Marine Turtles

Five of the six marine turtle species recorded for the NWS have the potential to occur within the Operational Area (Appendix C): the loggerhead, green, leatherback, hawksbill and flatback turtle.

There is no emergent habitat within the Operational Area or EMBA. Therefore, nesting aggregations of marine turtles would not be expected. A flatback turtle internesting BIA and 'habitat critical', extending from nesting locations at the Montebello Islands, overlaps with part of the Operational Area. The BIA is considered very conservative as it is based on the maximum range of internesting females. However, many turtles are likely to remain near their nesting beaches, and as they leave beaches they typically spread out and consequently, density decreases rapidly with increasing distance from a nesting beach. It is also possible that marine turtles forage at Rankin Bank, the nearest submerged shoal containing biota that turtles eat (e.g. sponges and macroalgae – see Section 4.7.4).

The 60 km internesting buffer for flatback turtles in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017), defined as habitat critical to the survival of a species, is based primarily on the movements of tagged internesting flatback turtles along the North West Shelf reported by Whittock et al. (2014), which found that flatback turtles may demonstrate internesting displacement distances up to 62 km from nesting beaches. However, these movements were confined to longshore movements in nearshore coastal waters or travel between island rookeries and the adjacent mainland (Whittock et al., 2014). There is no evidence to date to indicate flatback turtles swim out into deep offshore waters during the internesting period.

A more recent paper by the same authors (Whittock et al., 2016) has more precisely defined flatback turtle internesting habitat along the North West Shelf. The Whittock et al. (2016) study developed a habitat suitability map to identify areas where internesting flatback turtles may be present along the North West Shelf, based on data compiled for a suite of environmental variables and satellite tracks of 47 internesting flatback turtles from five different mainland and island rookeries tracked over 1289 days. Whittock et al. (2016) defined suitable internesting habitat as water 0–16 m deep and within 5–10 km of the coastline, while unsuitable internesting flatback habitat was defined as waters >25 m deep and >27 km from the coastline. The primary environmental variables that influenced flatback internesting movement were bathymetry, distance from coastline, and sea surface temperature. Suitable areas of internesting habitat were located close to many known flatback turtle rookeries across the region (Whittock et al., 2016). This modelling study clearly demonstrates that all of the internesting buffer BIA and 'habitat critical' overlapped by the Operational Area, or immediately adjacent to it, do not represent suitable habitat for flatback turtles during internesting periods. Hence it is highly unlikely that significant numbers of flatback turtles will be in the offshore, deep waters of the Operational Area. The evidence that suitable inter-nesting habitat for flatback turtles is likely to be limited to relatively shallow waters within close proximity of the coastline is further supported by data from satellite telemetry of 11 flatback turtles after nesting on the Lacepede Islands (Thums et al., 2017). This study found that "*During the inter-nesting phase, flatback turtles remained at an average distance of 15.75 ± 12.25 km from West Lacepede Island, in water depths of 16 ± 3 m…*" (Thums et al., 2017).

Four of the turtle species (green, loggerhead, flatback and hawksbill) have significant nesting rookeries on beaches along the mainland coast and islands in the region including the Montebello/Barrow/Lowendal Islands, Muiron Islands, North West Cape and Ningaloo Reef (Environment Australia, 2003; DoEE, 2017). Table 4-6 provides additional details of the marine turtle species identified, including breeding and nesting seasons, diet and key habitats (including BIAs) within the NWMR (including areas outside of the EMBA region). Figure 4-10 provides an overview of marine turtle BIAs in the region of the Operational Area.

Table 4-6: Key information on marine turtles in the North West Marine Region

Turtle species	Key seasons within the Northwest Shelf Province	Diet	Key habitats
Green turtle – NWS genetic stock	**Breeding:** About September to March **Nesting**: November to March. Peak period from January to February	Seagrasses and algae	**Preferred habitat**: Nearshore reef habitats in the photic zone. **Distribution**: Ningaloo Coast to Lacepede Islands. **Major nesting sites**: Adele Island, Maret Island, Cassini Island, Lacepede Islands, Barrow Island, Montebello Islands (all with sandy beaches), Serrurier Island, Dampier Archipelago, Thevenard Island, Northwest Cape, Ningaloo Coast (DoEE, 2017) **Internesting habitat**: Generally within 10 km of nesting beaches (Waayers et al., 2011). **Nearest BIA**: Nesting on the Montebello Islands during summer, with a 20 km internesting buffer, therefore the key habitat is outside the EMBA. **Nearest habitat critical to the survival of a species (**Commonwealth of Australia, 2017**)**: The Operational Area lies about 31 km from the 20 km internesting buffer around Montebello Islands.
Loggerhead turtle – WA genetic stock	**Breeding:** About September to March **Nesting**: October to March. Peak period from late December to early January	Carnivorous – feeding mainly on molluscs and crustaceans	**Preferred habitat**: Nearshore and island coral reefs, bays and estuaries in tropical and warm temperate latitudes. **Distribution:** Shark Bay to North West Cape and as far north as Muiron Islands and Dampier Archipelago. **Major nesting sites**: Principally from Dirk Hartog Island, along the Gnarloo and Ningaloo coast to North West Cape and the Muiron Islands. There have been occasional records from Varanus and Rosemary Islands in the Pilbara. Late summer nesting recorded for Barrow Island, Lowendal Islands and Dampier Archipelago. **Internesting habitat:** Limited data on Australian loggerhead turtles; however, literature indicates internesting habitat for this species is generally within 20 km of nesting beaches (Commonwealth of Australia, 2017). **Nearest BIA**: Nesting on the Montebello Islands (peak late December–early January) with a 20 km internesting buffer. Loggerhead nesting turtle habitat is outside the EMBA. **Nearest habitat critical to the survival of a species (**Commonwealth of Australia, 2017**)**: The Operational Area lies about 188 km from the 20 km internesting buffer around the Muiron Islands.
Hawksbill turtle – WA genetic stock	**Nesting**: October to February with a peak period in December and January	Mainly sponges – also seagrasses, algae, soft corals and shellfish	**Preferred Habitat:** Nearshore and offshore reef habitats. **Distribution:** Shark Bay north to Dampier Archipelago. **Major nesting sites:** The most significant rookery in WA is at Rosemary Island. Other rookeries include Varanus Island in the Lowendal group, some islands in the Montebello group and along the Ningaloo Coast. **Internesting habitat:** Limited data on Australian hawksbill turtles; however, literature indicates internesting habitat for this species is generally within 20 km of nesting beaches (Commonwealth of Australia, 2017).

Turtle species	Key seasons within the Northwest Shelf Province	Diet	Key habitats
			Nearest BIA: Nesting on the Montebello Islands in spring and early summer (peak October) with a 20 km internesting buffer. Hawksbill turtle nesting habitat is outside the EMBA. **Nearest habitat critical to the survival of a species (**Commonwealth of Australia, 2017**)**: The Operational Area lies about 31 km from the 20 km internesting buffer around the Montebello Islands.
Flatback turtle – Pilbara genetic stock	**Nesting**: October to March with peak period in December and January	Carnivorous – feeding mainly on soft bodied prey such as sea cucumbers, soft corals and jellyfish	**Preferred Habitat**: Nearshore and offshore sub-tidal and soft bottomed habitats of offshore islands. **Distribution:** Shark Bay north to Dampier Archipelago. **Major nesting sites**: The largest nesting sites of the Pilbara region are Barrow Island and the mainland coast (Mundabullangana Station near Cape Thouin and smaller nesting sites at Cemetery Beach in Port Hedland and Bell's Beach near Wickham). Other significant rookeries include Thevenard Island, the Montebello Islands, Varanus Island, the Lowendal Islands, and islands of the Dampier Archipelago. **Internesting habitat:** Up to 70 km from nesting beaches (Waayers et al., 2011). Satellite tracking of flatback turtle nesting populations at Barrow Island indicates this species travels to the east of Barrow Island, towards WA mainland coastal waters, between nesting events (Chevron, 2009; RPS, 2010d). Whittock et al. (2016) defined suitable internesting habitat as water 0–16 m deep and within 5–10 km of the coastline, while unsuitable internesting flatback habitat was defined as waters > 25 m deep and > 27 km from the coastline. **Nearest BIA:** Foraging, mating and nesting at the Montebello Islands in summer with an 80 km internesting buffer. Therefore this key habitat overlaps the Operational Area. **Nearest habitat critical to the survival of a species (**Commonwealth of Australia, 2017**)**: A 60 km internesting buffer surrounding nesting locations at Barrow Island and Montebello Islands overlaps with the Operational Area.
Leatherback turtle – Australia genetic stock	No confirmed nesting activity in WA	Carnivorous – feeding mainly in the open ocean on jellyfish and other soft-bodied invertebrates	**Preferred Habitat**: Nearshore, coastal tropical and temperate waters, may be encountered within the Northwest Shelf Province but noted that there are no known nesting sites within the Province.

Source: Department of Environment and Conservation (DEC) (2012), DSEWPaC (2012a), Commonwealth of Australia (2017)

Post-nesting migratory routes for green, hawksbill and flatback turtles recorded for the Northwest Shelf Province (Barrow Island and mainland sites) (Chevron, 2012), outside the EMBA, indicate no overlap with the Operational Area. Green, flatback and hawksbill turtles travelling from nesting sites to foraging grounds generally travelled east or south of Barrow Island, around or through the Dampier Archipelago and along the coast towards foraging grounds to the north (north of Broome). The hawksbill turtle is an exception as it tends to travel south to the coastal island chain south of Barrow Island (Chevron, 2012). Tracking data indicates the three marine turtle species recorded for the

Northwest Shelf Province travel and forage in coastal waters that are relatively shallow (Chevron, 2012) as follows:

- hawksbill turtles – less than 10 m deep
- green turtles – less than 25 m deep
- flatback turtles – less than 70 m deep.

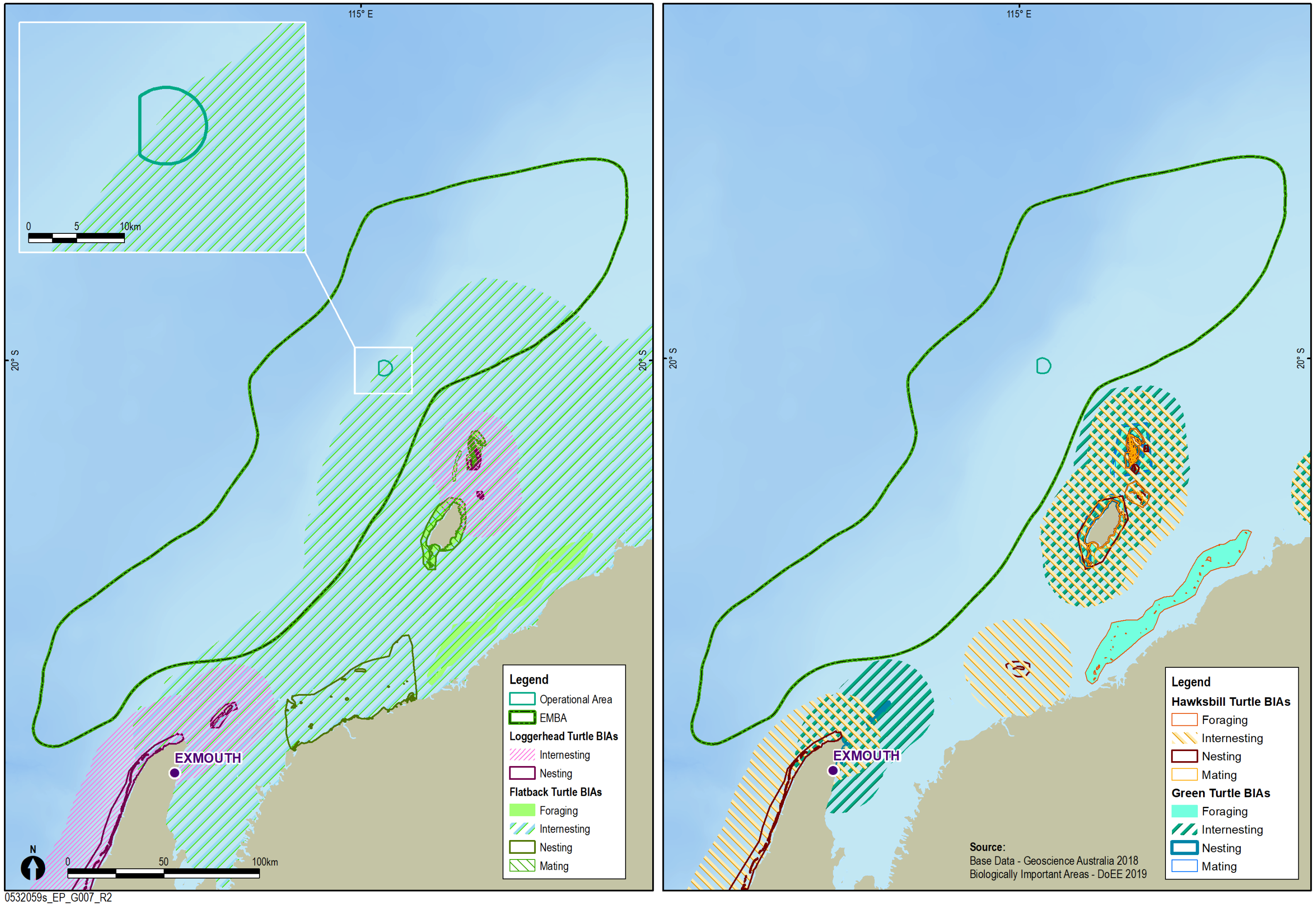


Figure 4-10: BIAs for marine turtles in the region of the Operational Area

Seasnakes

Seasnakes occur across the NWMR and are reported to occur in offshore and nearshore waters. They occupy diverse habitats including coral reefs, turbid water habitats and deeper water (Guinea et al*.,* 2004). Species exhibit habitat preferences depending on water depth, benthic habitat, turbidity and season (Heatwole and Cogger, 1993).

The short-nosed seasnake, listed as Critically Endangered under the EPBC Act, was identified as potentially occurring within the EMBA (although not within the Operational Area). There are a small number of records of individuals collected along the Western Australian coast from the Exmouth Gulf to Broome (Storr et al., 2002; Kangas et al., 2018a). The origin of these specimens has not been determined, but they may have been vagrants or they may represent a population which has not yet been identified. This species may have a wider distribution; however, there are no conclusive records relating to the species distribution outside Australian waters (DSEWPaC, 2011a).

Seasnakes of the families Hydrophidae and Laticaudidae are widespread in the EMBA and are protected under the EPBC Act. The Protected Matters Search identified 16 species of seasnake listed as marine under the EPBC Act within the EMBA (Appendix C). The most commonly sighted seasnake in the region is the olive seasnake (*Aipysurus laevis*), which is generally found along lower reef edges and upper lagoon slopes of leeward reefs. The olive seasnake is associated with shallow water, as large, deep water expanses create a significant barrier to movement.

Most seasnake species have depth distributions <50 m (Cook et al., 2016; Heatwole & Seymour 1975), however recent ROV surveys in the Browse Basin have sighted sea snakes of the genus *Hydrophis* at depths >200 m (Crowe-Riddell, 2019). Given the water depth of the Operational Area, seasnake sightings will be infrequent and likely comprise few individuals.

4.5.2.7 Fishes and Elasmobranchs

Seahorses, Pipehorses and Pipefishes

A search of the EPBC Act Protected Matters database identified the potential for 28 species of pipehorses and pipefishes and seven species of seahorses to occur in the Operational Area (Appendix C). However, by-catch data (DoF, 2010) indicates they are uncommon in deeper continental shelf waters (50–200 m) and therefore are unlikely to occur within the Operational Area.

This family (Syngnathidae) are commonly found within the nearshore and coastal waters of the EMBA, especially in seagrass and sandy habitats around coastal islands and shallow reef areas along the NWS. Syngnathidae are likely to be found in coastal areas including the Ningaloo area and the Dampier Archipelago. Recent data collected using Baited Remote Underwater Video System (BRUVS) at Rankin Bank did not record any seahorses, pipehorses or pipefishes (AIMS, 2014).

Sharks and Rays

<u>*Whale Shark*</u>

The DoEE has defined a BIA for foraging whale sharks (post aggregation at Ningaloo) centred on the 200 m isobath from July to November (Commonwealth of Australia, 2015d; Figure 4-11). This area extends northward from the Ningaloo aggregation area and partially overlaps with the south-east portion of the Operational Area. Anecdotal evidence from sightings data collected from the Woodside offshore facilities on the NWS indicate whale sharks are present on the NWS in the months of April, July, August, September and October, corresponding with the whale shark's seasonal migration to and from the Ningaloo Reef. However, the numbers of individual whale sharks that transit through the Operational Area is expected to be low, based on the number of whale sharks aggregating at Ningaloo and on the different migration paths that the sharks may follow (see below).

Whale sharks aggregate annually to feed in the waters around Ningaloo Reef (about 206 km south west of the Operational Area and outside the EMBA) from March to July, with the largest numbers recorded in April and May (Sleeman et al., 2010). However, seasonal aggregation can be variable, with individual whale sharks recorded at other times of the year. The super-population (comprising individuals that visit the reef at some point during their lifetime) has been estimated to range between 300 and 500 individuals. It is expected that the number visiting Ningaloo Reef in any given year will be somewhat smaller (Meekan et al., 2006). Timing of the whale shark migration to and from Ningaloo coincides with the coral mass spawning period when there is an abundance of food (krill, planktonic larvae and schools of small fish) in the waters adjacent to Ningaloo Reef. At Ningaloo Reef, whale sharks stay within a few kilometres of the shore and in waters about 30–50 m deep (Woodside, 2002; Wilson et al., 2006).

After the aggregation period, the distribution of the whale sharks is largely unknown. Tagging, aerial and vessel surveys suggest that the group disperses widely, up to 1800 km away into Indonesian waters. Satellite tracking has shown that the sharks may follow three migration routes from Ningaloo:

1. north-west, into the Indian Ocean
2. directly north, towards Sumatra and Java
3. north-east, passing through the NWS and Browse, travelling along the shelf break and continental slope (Meekan & Radford, 2010) (Figure 4-11).

Though the BIA has been defined as foraging for whale sharks, based on the literature it is more likely to be a migration pathway with whale sharks undertaking opportunistic foraging. Given the BIA for whale sharks spatially overlaps the Operational Area, it is expected that whale sharks may traverse the vicinity of the Operational Area during their migrations to and from Ningaloo Reef. However, it is expected that whale shark presence within the area would be of a relatively short duration and not in significant numbers, given the main aggregations are recorded in coastal waters, particularly the Ningaloo Reef edge (Marine Parks and Reserves Authority (MPRA), 2005).

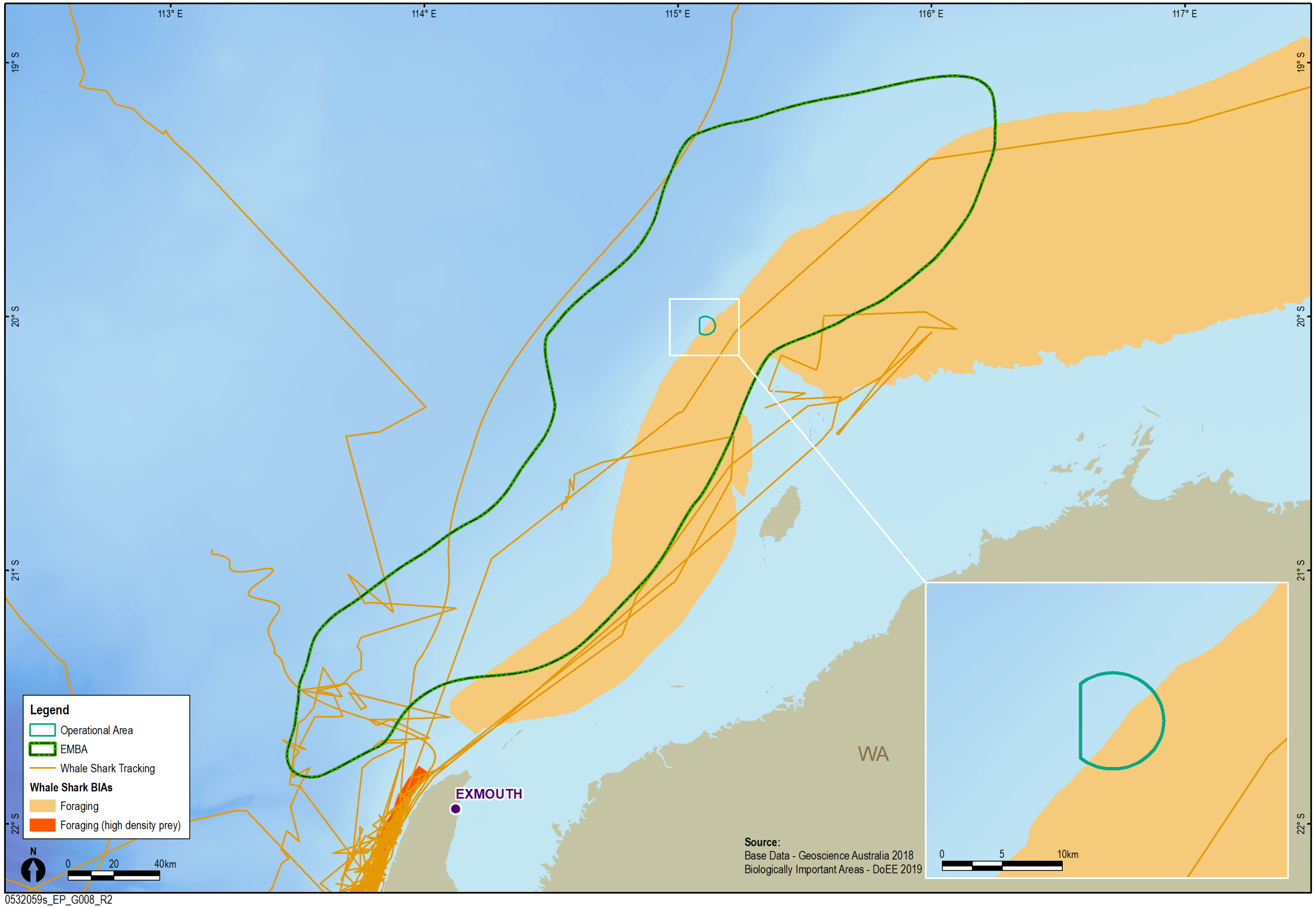


Figure 4-11: Whale shark BIAs and short- and long-term satellite tracking of 15 whale sharks tagged between 2005 and 2008

Grey Nurse Sharks

The grey nurse shark has a broad inshore distribution, primarily in sub-tropical to cool temperate waters (Last & Stevens, 1994) and is predominantly found in the south-west coastal waters of WA and as far north as the NWS (Stevens, 1999; Pogonoski et al., 2002). The grey nurse shark is generally found between 15 and 40 m (Otway & Parker, 2000). The Operational Area is in offshore waters and as such, sightings of grey nurse sharks are considered highly unlikely to occur in the Operational Area. However, grey nurse sharks are likely to be found within the EMBA.

Great White Shark

The great white shark typically occurs between the coast and the 100 m depth contour, although adults and juveniles have been recorded diving to depths of 1000 m (Bruce et al., 2006; Bruce & Bradford, 2008). They are also known to make open ocean excursions of several hundred kilometres and can cross ocean basins (for instance from South Africa to the western coast of Australia) (Weng et al., 2007). Along the WA coastline, great white sharks move up the coast as far as North West Cape during spring and appear to return during the summer (CMAR, 2007). Great white sharks are often found in regions with high prey density, such as pinniped colonies (DEWHA, 2009b). Occurrence of great white sharks within the Operational Area is likely to be infrequent and restricted to transiting individuals.

Green Sawfish

Green sawfish were once widely distributed in coastal waters along the northern Indian Ocean, although it is believed that northern Australia may be the last region where significant populations exist (Stevens et al., 2005). Within Australia, green sawfish are currently distributed from around the Whitsundays in Queensland, across northern Australian waters to Shark Bay in WA (Commonwealth of Australia, 2015e). Green sawfish are present in coastal waters and tidal creeks and, despite records for deeper offshore waters, their range is mostly restricted to the inshore fringe with a strong association to mangroves and adjacent mudflat habitats (Commonwealth of Australia, 2015e). The Multi-species Recovery Plan for Sawfish and River Sharks indicates 'known to occur' distribution includes offshore waters of the NWS of Australia, 2015e). The Operational Area is not considered a sensitive area for the green sawfish.

Based on the distance from preferred shallow coastal habitats and the water depth of the Operational Area (about 166–511 m), it is highly unlikely that green sawfish will occur within the Operational Area, although they may be present within the EMBA.

Narrow Sawfish

The narrow sawfish occurs from the northern Arabian Gulf to Australia and north to Japan. The species inhabits inshore and estuarine waters and offshore waters up to depths of 100 m (D'Anastasi et al., 2013) and are most commonly found in sheltered bays with sandy bottoms. They are not currently listed as threatened but are commonly caught as by-catch, and constituted over half of sawfish by-catch in the Northern Prawn Fishery in 2013 (Morgan et al., 2010). The species was identified as potentially occurring within the Operational Area; however, due to water depths are unlikely to be present at the depths associated with the Operational Area. Narrow sawfish may occur in the EMBA, particularly in nearshore estuarine environments.

Shortfin Mako

The shortfin mako is a wide-ranging oceanic pelagic shark that is widespread in Australian waters, though rarely recorded in water temperatures below 16 °C (DEWHA, 2010). Recently tagged shortfin makos spent most of their time in water less than 50 m deep but with occasional dives up to 880 m deep (Stevens et al., 2010; Abascal et al., 2011). Little is known about the population size and distribution of shortfin mako sharks in WA; however, it is possible they will transit the Operational

Area. It is expected that the number of individuals encountered will be low due to their preference for shallow waters (<50 m) but it is likely they will be within the broader EMBA.

Longfin Mako

The longfin mako is a widely distributed but rarely encountered oceanic tropical shark found in Australian waters south to Geraldton in WA (outside the EMBA) and to at least Port Stephens in New South Wales (DEWHA, 2010). The longfin mako is often confused with the shortfin mako. There is very little information about these sharks in Australia, with no available population estimates or distribution trends. Occurrence within the Operational Area is likely to be infrequent and restricted to transiting individuals. However, it is likely they will be within the broader area including the NWS region and the EMBA.

Dwarf Sawfish

The dwarf sawfish is found within a range from Cairns and along coastline around the Cape York Peninsula, in Queensland, to the Pilbara coastline in WA (Last & Stevens, 1994; Stevens et al., 2008). The dwarf sawfish is generally found in shallow coastal waters (depths of 2 to 3 m) and estuarine habitats. The dwarf sawfish was not identified by the PMST search as potentially occurring within the Operational Area, however due to their migratory distribution they may be present within shallower waters at south-east extent of the EMBA.

Giant Manta Ray

The giant manta ray is very common in tropical waters of Australia and the Montebello Islands Marine Park/Barrow Island Marine Management Area. The giant manta ray primarily inhabits near-shore environments along productive coastlines with regular upwelling, but they appear to be seasonal visitors to coastal or offshore sites including offshore island groups, offshore pinnacles and seamounts (Marshall et al., 2011). The Operational Area is not located in or adjacent to any known key aggregation areas for the species (e.g. feeding or breeding). Occurrence of giant manta rays within the Operational Area is likely to be infrequent, and restricted to individuals transiting the area.

Reef Manta Ray

The reef manta ray is globally distributed in tropical and subtropical waters. It is a planktivorous species and is thought to migrate relatively long distances, travelling up to 70 km per day and moving between specific productive areas (Couturier et al., 2011; van Duinkerken, 2010). The reef manta ray is most often sighted inshore, around coastal areas and coral reefs. Species residency has been recorded along the Western Australian coastline, most notably at Ningaloo Marine Park. The Operational Area is not located in or adjacent to any known key aggregation areas for the species (e.g. feeding or breeding). Occurrence of reef manta rays within the Operational Area is likely to be infrequent, and restricted to individuals transiting the area.

4.5.2.8 Birds

Seabirds and/or Migratory Shorebirds within the Operational Area

Twelve species of listed threatened and/or migratory birds were identified by the EPBC Act Protected Matters Search (Appendix C) as potentially occurring within the Operational Area (Table 4-3), being:

- southern giant petrel (*Macronectes giganteus*) – Endangered and Migratory
- red knot (*Calidris canutus*) – Endangered
- eastern curlew (*Numenius madagascariensis*) – Critically Endangered
- Australian fairy tern (*Sternula nereis nereis*) – Vulnerable
- curlew sandpiper (*Calidris ferruginea*) – Critically Endangered.

- common noddy (*Anous stolidus*) – Migratory
- streaked shearwater (*Calonectris leucomelas*) – Migratory
- lesser frigatebird (*Fregata ariel*) – Migratory
- pectoral sandpiper (*Calidris melanotos*) – Migratory
- osprey (*Pandoin heliaetus*) – Migratory
- common sandpiper (*Actitis hypoleucos*) – Migratory
- sharp-tailed sandpiper (*Calidris acuminate*) – Migratory

The Operational Area may be occasionally visited by migratory and oceanic birds but does not contain any emergent land that could be used as roosting or nesting habitat. It contains no known critical habitats (including feeding) for any species. However, a foraging BIA defined by the DoEE for the migratory wedge-tailed shearwater during its breeding period in the region (August to April) overlaps the Operational Area (Figure 4-12). The wedge-tailed shearwater is a breeding visitor to the Kimberley, Pilbara and Gascoyne coasts and is listed as Migratory under the EPBC Act. Note that the EPBC PMST did not identify wedge-tailed shearwaters as potentially occurring within the Operational Area or EMBA.

No critical habitat associated with the southern giant-petrel has been identified for the Operational Area; therefore the presence of this species within the Operational Area is likely to be infrequent as individuals traverse the area.

Based on the results of two survey cruises and other unpublished records, Dunlop et al. (1995) recorded the occurrence of 18 species of seabirds over the Northwest Shelf Province. These included a number of species of petrel, shearwater, tropicbird, frigatebird, booby and tern, as well as the silver gull. Of these, eight species occur year-round, and the remaining ten are seasonal visitors. From these surveys, it was noted that seabird distributions in tropical waters were generally patchy, except near islands. Migratory shorebirds may be present in or fly through the region between July and December, and again between March and April, as they complete migrations between Australia and offshore locations (Environment Australia, 2002).

Threatened species of seabirds that were identified as potentially occurring within the Operational Area are described in detail below.

<u>Southern Giant Petrel</u>

The southern giant petrel is the largest species of petrel, and is listed as Endangered and Migratory under the EPBC Act. The southern giant petrel occurs in Antarctic to subtropical waters, and breeds on six sub-Antarctic- and Antarctic islands, which are all outside the EMBA. The species is thought to travel varied and potentially long migratory pathways between foraging and breeding habitat (DSEWPaC, 2012d). Due to preferred habitat and known movement patterns, the species is not expected to occur within the Operational Area, but may be in the southern region of the EMBA.

<u>Red Knot</u>

The red knot is listed as Endangered and Migratory under the EPBC Act. The species undertakes long distance migrations from breeding grounds in high northern latitudes, where it breeds during the boreal summer, to the southern hemisphere during the austral summer. Both Australia and New Zealand host significant numbers of red knots during their non-breeding period (Bamford et al., 2008). As with other migratory shorebirds, the species occurs in coastal wetland and intertidal sand or mudflats throughout the EMBA, but is unlikely to occur in the Operational Area, aside from individuals occasionally transiting through during migrations, due to the lack of emergent habitat.

Eastern Curlew

The eastern curlew is Australia's largest shorebird, and is listed as Critically Endangered and Migratory under the EPBC Act. The eastern curlew is a coastal species with a continuous distribution north from Barrow Island to the Kimberley region. The species is endemic to the East Asian–Australasian Flyway. The species is a non-breeding visitor to Australia from August to March, primarily foraging on crabs and molluscs in intertidal mudflats. Due to the lack of emergent habitat, the eastern curlew is not expected to occur within the Operational Area; however, will potentially be present at coastal locations within the EMBA, particularly at the peak of migration during the Australian summer.

Australian Fairy Tern

The Australian fairy tern is listed as Vulnerable under the EPBC Act. It has a coastal distribution from Sydney, south to Tasmania and around southern WA up to Dampier. The Australian fairy tern feeds on small baitfish and roosts and nests on sandy beaches below vegetation (Higgins & Davies, 1996; Van de Kam et al., 2004). Although identified by the EPBC search as occurring within the Operational Area, due to the coastal distribution of the species the Australian fairy tern is unlikely to occur within the Operational Area. However, it is likely to occur in the coastal regions of the EMBA.

Curlew Sandpiper

The sharp-tailed sandpiper is listed as critically endangered and migratory under the EPBC Act. Like other species of sandpiper, the curlew sandpiper is a migratory wading shorebird and seasonally migrates long distances between breeding grounds in the northern hemisphere and over-wintering areas in the southern hemisphere (Bamford et al., 2008). Curlew sandpipers mainly occur on intertidal mudflats in sheltered coastal areas and forage on mudflats and nearby shallow water. The species may occur in Australia between late August to March. Due to lack of suitable habitat, the species is highly unlikely to occur within the Operational Area or EMBA.

Seabirds and/or Migratory Shorebirds within the EMBA

An additional three listed threatened and/or migratory species of birds were identified as potentially occurring within the EMBA (Table 4-3). There are several important habitats for seabirds and migratory shorebirds along the Pilbara coast, including key breeding/nesting areas, at the islands of the Montebello/Barrow/Lowendal Islands Group and the Pilbara Southern Island group, however these are located beyond the EMBA.

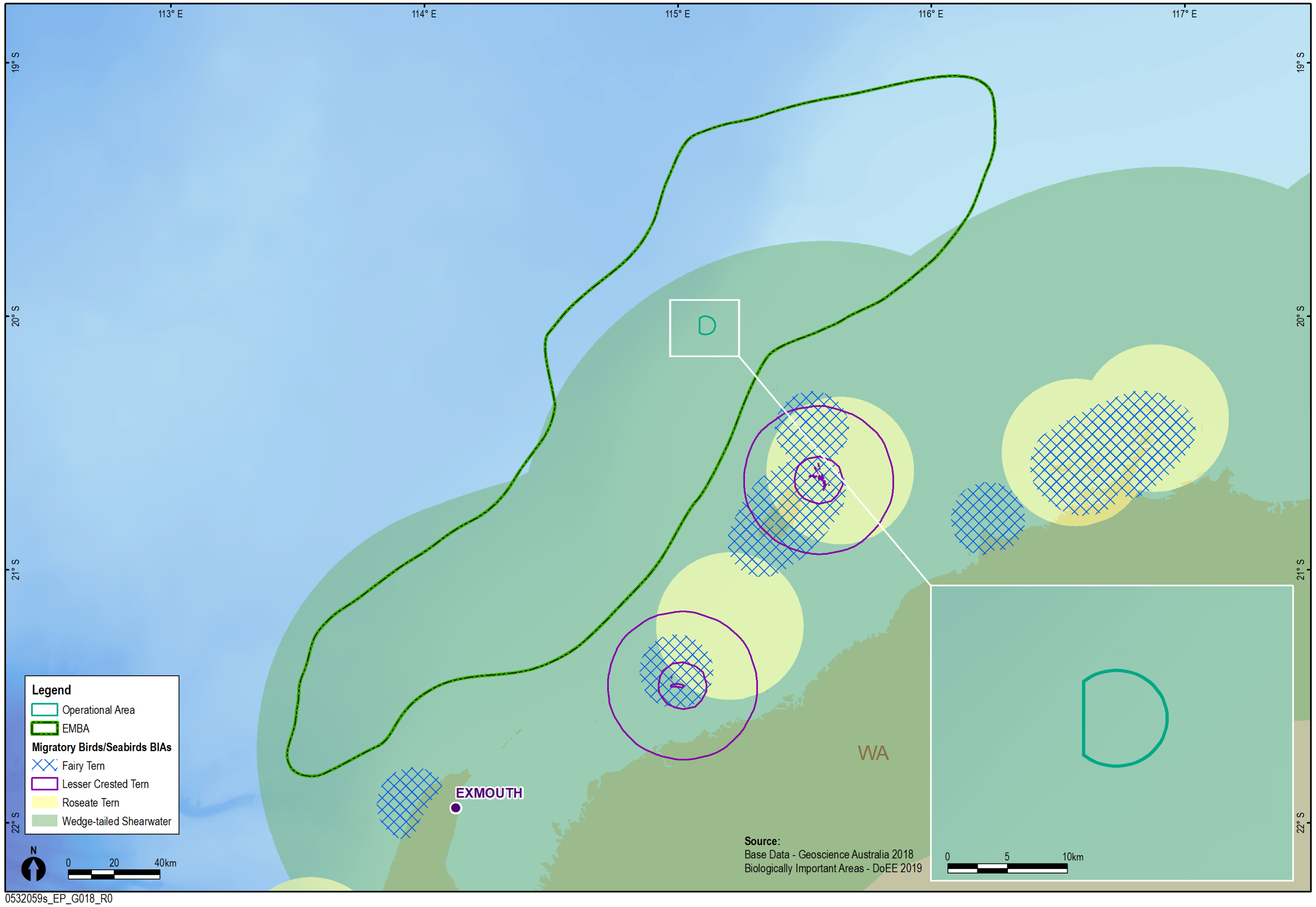


Figure 4-12: BIAs for seabirds in relation to the Operational Area

4.6 Socio-economic and Cultural Environment

4.6.1 Cultural Heritage

4.6.1.1 European Sites of Significance

There are no known sites of Indigenous or European cultural heritage significance within the vicinity of the Operational Area or EMBA.

4.6.1.2 Indigenous Sites of Significance

Indigenous heritage places are protected under the *Aboriginal Heritage Act 1972* (WA) or EPBC Act. The DPLH Heritage Inquiry System was used to search an area encompassing the EMBA and socio-cultural EMBA (Appendix G). The search indicated no registered sites occur within the EMBA or socio-cultural EMBA (Appendix G).

4.6.1.3 Historic Shipwrecks and Sunken Aircraft

Historic shipwrecks and sunken aircraft are protected and managed under the *Underwater Cultural Heritage Act 2018*.

A search of the National Shipwreck Database (DoE, 2014b) indicates there are no known historic shipwrecks or sunken aircraft within the Operational Area, EMBA or socio-cultural EMBA. The closest known wreck to the Operational Area is the Trial, wrecked at Trial Rocks approximately 35 km south-east of the Operational Area and beyond the wider EMBA.

4.6.1.4 National and Commonwealth Heritage Listed Places

The National Heritage List is Australia's list of natural, historic and Indigenous places of outstanding significance to the nation (DoE, n.d.). The Commonwealth Heritage List is a list of Indigenous, historic and natural heritage places owned or controlled by the Australian Government. These include places connected to defence, maritime safety, communications, customs and other government activities that also reflect Australia's development as a nation (DoE, n.d).

A search of the Australian Heritage Database confirmed that no National or Commonwealth Heritage Listed Places are located within the EMBA.

4.6.2 Ramsar Wetlands

Ramsar wetlands are sites that have been included on the List of Wetlands of International Importance on the basis of representativeness or uniqueness or of biodiversity values. There are no Ramsar wetlands within or immediately adjacent to the Operational Area. The closest Ramsar wetland occurs at Eighty Mile Beach, over 475 km east of the Operational Area and beyond the EMBA.

4.6.3 Fisheries – Commercial

4.6.3.1 Commonwealth and State Fisheries

A number of Commonwealth and State fisheries are located within, adjacent to, or in the region of the Operational Area. Table 4-7 provides further detail on the fisheries that have been identified through desk based assessment and consultation (Section 5).

Figure 4-13 to Figure 4-15 provide the designated fisheries management areas in relation to the location of the Operational Area.

Table 4-7: Commonwealth and State fisheries within or adjacent to the Operational Area

Fishery	Management area overlap with:			Description
	Operational Area	EMBA	Potential for interaction within Operational Area	
Commonwealth				
North West Slope Trawl Fishery	✓	✓	✓	**Description:** The North West Slope Trawl Fishery (NWSTF) management area occurs from 114°E to 125°E and between the 200 m isobath to the outer limit of the Australian Fishing Zone (Figure 4-13). The Operational Area overlaps with a very small portion of the NWSTF management area (approximately 2 km^2 of the 400,000 km^2 management area). The NWSTF traditionally targets scampi and deepwater prawns. Fishing for scampi occurs over soft, muddy sediments or sandy habitats, typically at depths of 350–600 m using demersal trawl gear on the continental slope (Department of Agriculture, Fisheries and Forestry (DAFF), 2014). The major landing ports for the NWSTF include Darwin and Point Samson. Four vessels were active in the 2017-18 season, an increase from two vessels active in the 2016-17 season. Accordingly, total scampi catch in the fishery increased in 2017-18 than in the previous year, 57.7 t up to 79.7 t (Patterson et al., 2019). Fishing effort often increases when boats cease to operate in the Northern Prawn Fishery in a given season and move to the NWSTF. Fishing effort from the NWSTF may occur within the Operational Area and wide EMBA. **Fishing boundary distance from the Operational Area:** The NWSTF management boundary partially overlaps with the Operational Area. **Active vessels:** Four vessels (Patterson et al., 2019).
Western Tuna and Billfish Fishery	✓	✓	**X**	**Description:** The Western Tuna and Billfish Fishery management area extends west from the Gulf of Carpentaria to the South Australian/Victorian border. Fisheries data indicates that this long-line fishery has been declining since 2001, with a total of 95 statutory fishing rights and fewer than five active vessels since 2005 (Patterson et al., 2019). The majority of fishing effort occurs off south-west Australia, distant from the Operational Area and outside the EMBA. (Figure 4-13). **Fishing boundary distance from the Operational Area:** Overlaps the Operational Area. **Vessels:** Three vessels (two pelagic longline, one minor longline).

Fishery	Management area overlap with: Operational Area	EMBA	Potential for interaction within Operational Area	Description
Southern Bluefin Fishery and Western Skipjack Fishery	✓	✓	**X**	**Description:** The Southern Bluefin Tuna Fishery management area and the Western Skipjack Tuna Fishery (WSTF) management area covers the entire Australian Fishing Zone. Both fisheries constitute a single, highly migratory stock that spawns in the north-east Indian Ocean and migrates throughout the temperate southern oceans. Tuna is one of the most highly valued fish species and is targeted by fishing fleets from a number of nations, both on the high seas and within the Exclusive Economic Zones of Australia, New Zealand, Indonesia and South Africa (Australian Fisheries Management Authority (AFMA), 2010). The majority of the fishing effort for the Southern Bluefin Tuna Fishery occurs in the Great Australian Bight and north-east of Eden in New South Wales (Patterson et al., 2019). No fishing activity for the WSTF has been recorded since the 2008–2009 fishing season as a result of the natural variability of skipjack tuna stocks in Australian waters and low unit price for this species (Patterson et al., 2019; Georgeson et al., 2014). Fishing activity for either of these tuna fisheries is not expected within the Operational Area. **Fishing boundary distance from the Operational Area:** Overlaps the Operational Area. **Active vessels:** Seven purse seine vessels and 31 longline vessels active in the SBTF (Patterson et al., 2019). No vessels are active in the WSTF.
Western Deepwater Trawl Fishery	X	✓	**X**	**Description:** The Western Deepwater Trawl Fishery is permitted to operate only in deep waters from the 200 m isobath, as far north as the North West Cape, outside of the Operational Area but within the EMBA (Figure 4-13). This fishery targets a number of deep water, demersal finfish and crustacean species. The nominated fishing grounds are extensive; however, most of the fishing effort is south and offshore of the North West Cape. Effort increased from one vessel spending 11 days fishing in the 2017-17 season, to three vessels spending 100 days fishing in the 2017-18 season (Patterson et al., 2019). Areas of medium and high density fishing activity are located to the south of Ningaloo Reef and west of Shark Bay, beyond the 200 m isobath (Patterson et al., 2019). **Fishing boundary distance from the Operational Area:** The Western Deepwater Trawl Fishery management boundary is located about 70 km west of the Operational Area. **Active vessels:** Three vessels (Patterson et al., 2019).
State				
West Australian Mackerel Managed Fishery	✓	✓	**X**	**Description:** The West Australian Mackerel Managed Fishery (MMF) operates in waters along the NWS, outside the Operational Area but within the EMBA. The MMF targeting Spanish mackerel (*Scomberomorus commerson*) using near-surface trolling gear from small vessels in coastal areas around reefs, shoals and headlands (Lewis and Brand-Gardner, 2019). Jig fishing is also used to capture grey mackerel (*S. semifasciatus*), with other species from the genera *Scomberomorus* (Molony et al., 2014). Spanish mackerel is found in Australian waters from Geographe Bay in south-west WA, throughout northern Australian waters and down the east coast as far as St. Helens in Tasmania (DoF, 2004).

Fishery	Management area overlap with:			Description
	Operational Area	EMBA	Potential for interaction within Operational Area	
				The commercial fishery extends from Geraldton to the Northern Territory border. There are three managed fishing areas: Kimberley (Area 1), Pilbara (Area 2), and Gascoyne and West Coast (Area 3). The majority of the catch is taken in the Kimberley region, reflecting the tropical distribution of mackerel species (Lewis and Brand-Gardner, 2019). The Operational Area is located in the Pilbara fishing area (Area 2), where the majority of fishing activity occurs around the coastal reefs of the Dampier Archipelago and Port Hedland area, away from the Operational Area, with the seasonal appearance of mackerel in shallower coastal waters most likely associated with feeding and gonad development prior to spawning (Molony et al., 2014). The EMBA extends into Area 3, which extends from the Gascoyne to Cape Leeuwin. The commercial fishery takes place over about six months from May – November, when Spanish mackerel are abundant in coastal areas (Lewis and Brand-Gardner, 2019). Spanish mackerel spawn between September and January when inhabiting coastal reef areas of the NWS, with females exhibiting serial spawning behaviour (spawning every one to three days) over the spawning period. Outside the main fishing season it is unclear where the mackerel populations inhabit, although there is anecdotal evidence to suggest populations move into deeper offshore waters (Fletcher & Santoro, 2014). The Mackerel Managed Fishery does not fish within the Operational Area, but is active within the EMBA (Department of Primary Industries and Regional Development (DPIRD), 2019a). **Fishing boundary distance from the Operational Area:** Overlaps the Operational Area. **Active vessels:** 13 vessels fished during the 2017 mackerel fishing season, employing approximately 30 people, primarily from May to November (Lewis and Brand-Gardner, 2017).

Fishery	Management area overlap with:			Description
	Operational Area	EMBA	Potential for interaction within Operational Area	
Pearl Oyster Managed Fishery, Pearl Leases	✓	✓	X	**Description:** The Western Australian Pearl Oyster Fishery is the only remaining significant wild-stock fishery for pearl oysters in the world (Hart et al., 2019a). The species targeted is the Indo-Pacific silver-lipped pearl oyster (*Pinctada maxima*), which is collected in shallow coastal waters along the NWS using divers, and are mainly used to culture pearls. No fishing effort occurs within or nearby the Operational Area (DPIRD 2019a). The fishery is separated into four zones. The Operational Area overlaps the Pearl Oyster Zone 1, which extends from North West Cape (including Exmouth Gulf) (119°30´E) to Cape Thouin (118°20´E). Fishing in Zone 1 has occurred as a low proportion (<1%) of the total annual catch after a hiatus from 2008–2013 (Hart et al., 2018), and in 2017 there was no fishing undertaken in Zone 1 (Hart et al., 2019a). The number of wild-caught pearl oyster shell in Zone 2 and 3 was 468,573 combined in 2017. Zones 2 and 3 are located outside the EMBA. Primary spawning of the pearl oyster occurs from mid-October to December. A smaller secondary spawning occurs in February and March (Hart et al., 2014). In the Gascoyne region beyond the EMBA, oysters are produced in hatcheries. Hatcheries in Carnarvon and Exmouth supply significant quantities of *P. maxima* spat to pearl farms in Exmouth Gulf and the Montebello Islands, while several hatcheries supply juveniles of the blacklip pearl oyster (*P. margaritifera*) to the region's developing black pearl farms. **Fishing boundary distance from the Operational Area:** The Operational Area overlaps the Pearl Oyster Zone 1. **Divers:** 12,845 diver hours and 468,573 shells (Hart et al., 2019a).
Beche-de-mer Fishery	✓	✓	X	**Description:** The sea cucumber or 'Beche-de-mer' fishery is a hand-harvested fishery that can be conducted within all Western Australian waters (Hart et al., 2019b). Collection methods are limited to shallow, coastal waters (methods principally by diving or wading) and no effort occurs within the Operational Area (DPIRD 2019a). This nearshore fishery is predominantly a single species fishery with 99% of the catch being sandfish (*Holothuria scabra*). The fishery was worth an estimated $400,000 in 2017 (Hart et al., 2018b) with a total catch of 135 tonnes (Hart et al., 2019b). There are specific areas closed to this fishery including the Dampier Archipelago and Rowley Shoals (DoF, 2012a). Less than three licences have been active at the Montebello/Barrow Islands Group (within the EMBA) between 2014 and 2018 (DPIRD, 2019a). Fishing is usually concentrated in the Kimberley region (Gaughan & Santoro, 2018). **Fishing boundary distance from the Operational Area:** Overlaps the Operational Area. **Vessels:** Not applicable (shore-based).

Fishery	Management area overlap with:			Description
	Operational Area	EMBA	Potential for interaction within Operational Area	
Marine Aquarium Fish Managed Fishery	✓	✓	**X**	**Description:** The Marine Aquarium Fish Managed Fishery (MAFMF) can be conducted in WA state waters, within the Operational Area and EMBA. The MAFMF is primarily a dive-based fishery that uses hand-held nets to capture target species operating from boats up to 8 m in length. The fishery is typically active from Esperance to Broome, with popular areas including the coastal waters of the Capes region, Dampier and Exmouth. The landed catch was predominantly ornamental fish but also included seahorses, invertebrates, corals and live rock (Newman et al., 2019). No effort from the MAFMF occurs within the Operational Area, and the MAFMF has not been active in the Montebello/Barrow Island area since 2013, when less than three vessels were active (DPIRD, 2019b). **Fishing boundary distance from the Operational Area:** Overlaps the Operational Area. **Licences:** 11 licences were active in 2017 (Newman et al., 2019).
Specimen Shell Managed Fishery	✓	✓	**X**	**Description:** The Specimen Shell Managed Fishery can operate in WA state waters, within the Operational Area and EMBA. Effort is concentrated in the areas adjacent to the largest population centres, such as Broome, Karratha, Exmouth, Carnarvon and Perth (Fletcher & Santoro, 2014). The Specimen Shell Managed Fishery collects specimen shells for display, collection, cataloguing and sale. Collection is predominantly by hand when diving or wading in shallow coastal waters. However, deeper water collection has recently commenced with the employment of ROVs at water depths up to 300 m. No fishing effort from the Specimen Shell Managed Fishery occurs within or nearby the Operational Area (DPIRD 2019). The Specimen Shell Managed Fishery consistently fishes around the Montebello/Barrow Island area, with less than three licences fishing in the area between 2013 and 2017 (DPIRD, 2019). In 2017 there were 31 licence holders in the fishery, with 23 of these being active in 2017 (Hart et al., 2018c). The Specimen Shell Managed Fishery reported a total catch of 7806 shells in 2017, with a catch rate of 10–40 shells per day. **Fishing boundary distance from the Operational Area:** Overlaps the Operational Area. **Vessels:** 31 authorisation holders in this fishery with around nine licences recording consistent activity. The number of people employed regularly in the fishery is likely to be around 20 (Hart et al, 2018c).
Onslow Prawn Managed Fishery	✓	✓	**X**	**Description:** The Onslow Prawn Managed Fishery encompasses a portion of the Pilbara region including nearshore waters and offshore waters within the Operational Area and EMBA (Figure 4-15). However, trawling activity is only permitted in seven managed nearshore areas, with strict seasonal fishing and voluntary moon closure periods for three days around the full moon period (Sporer et al. 2014). Only 5 days of fishing effort was undertaken by one boat in 2017 (Kangas et al. 2019). **Fishing boundary distance from the Operational Area:** Overlaps the Operational Area. **Vessels:** One vessel (Kangas et al., 2019).

Fishery	Management area overlap with: Operational Area	EMBA	Potential for interaction within Operational Area	Description
Pilbara Demersal Scalefish Fisheries (Pilbara Trawl, Trap and Line)	✓	✓	✓	**Description:** The State-regulated North Coast Demersal Fisheries comprise several management units in the Pilbara and Kimberley regions targeting a range of low and high value finfish species using several gear types (trawl, trap and line). Within the Pilbara, the Pilbara Demersal Scalefish Fisheries include the Pilbara Fish Trawl (Interim) Managed Fishery, the Pilbara Trap Managed Fishery and the Pilbara Line Fishery. The highest effort for these fisheries occurs between September and May (Fletcher & Santoro, 2014). The bulk of the catch consists of small, low value fish (spangled emperor, flagfish, threadfin bream). However, larger and more valuable fish such as red emperor, jobfish and rankin cod are also targeted. The Pilbara Fish Trawl Managed Fishery lands the largest component of the catch, operating in depths between 50 and 200 m (Fletcher & Santoro, 2014). The Pilbara Fish Trawl Managed Fishery is of high intensity and is divided into two zones: Zone 1 is closed to trawling and Zone 2 comprises six management areas, with Areas 3 and 6 closed to trawling (DoF, 2010). The Operational Area is located at the northern extent of Zone 1 (Figure 4-14). While no fishing is permitted within the Operational Area, the Pilbara Fish Trawl Managed Fishery is expected to fish within the EMBA. The Pilbara Trap Managed Fishery covers the area from Exmouth northwards and eastwards to the 120° line of longitude, and offshore to approximately the 200 m isobath. This fishery targets high value species such as red emperor and goldband snapper. It includes six licences consolidated onto three vessels, operating principally from Onslow. Traps are limited in number with the greatest effort in waters less than 50 m depth. Due to water depths, the Pilbara Trap Managed Fishery is not expected to fish within the Operational Area, but may fish in the EMBA. The Pilbara Line Fishery encompasses all of the 'Pilbara waters' and is the smallest fishery in terms of monetary value (Fletcher & Santoro, 2014), and by annual catch (Newman et al., 2019). Area 3 is closed to line fishing. There are no stated depth limits and the western extent of the fishery is the boundary of the Australian Fishing Zone. The Pilbara Line Fishery may operate within the Operational Area and EMBA. The proposed timing of the Petroleum Activities Program may overlap with the spawning times for a number of key fish species that have the potential to spawn within the region (red emperor *Lutjanus sebae*, Sept-June, with bimodal peaks from Sept-Nov and Jan-Mar; baldchin groper *Choerodon rubescens*, Sep–Feb; spangled emperor *Lethrinus nebulosus*, Sep–Dec; goldband snapper *Pristipomoides multidens,* Oct-May; rankin cod *Epinephelus multiinotatus*, June-Dec and Mar, peak spawning period Aug-Oct); blue spotted emperor *Lethrinus punctulatus,* Jul-Mar). **Fishing boundary distance from the Operational Area:** Overlaps the Operational Area. **Vessels:** Ten active in 2017 (2 trawl, 3 trap and 5 line fishery vessels), employing approximately 33 people.

Fishery	Management area overlap with:			Description
	Operational Area	EMBA	Potential for interaction within Operational Area	
South West Coast Salmon Managed Fishery	✓	✓	X	**Description:** The South West Coast Salmon Managed Fishery operates on various beaches south of metropolitan Perth and includes all Western Australian waters north of Cape Beaufort except Geographe Bay. This fishery uses beach seine nets to take Western Australian salmon (*Arripis truttaceus*). No fishing takes place north of the Perth metropolitan area, despite the managed fishery boundary extending to the WA /Northern Territory border. No interactions with participants in the fishery will occur during the Petroleum Activities Program. **Fishing boundary distance from the Operational Area:** Overlaps the Operational Area. **Vessels:** Not applicable (shore-based).
West Coast Deep Sea Crustacean Managed Fishery	✓	✓	X	**Description:** The West Coast Deep Sea Crustacean Managed Fishery operates outside of the Operational Area but within the EMBA, targeting crystal (snow) crabs (*Chaceon albus*), giant (king) crabs (*Pseudocarcinus gigas*) and champagne (spiny) crabs (*Hypothalassia acerba*) using baited pots operated in a long-line formation in the shelf edge waters (>150 m but mostly in depths of 500–800 m) of the west coast. In 2017, the total reported catch was 164.4 t (How and Orme, 2019). **Fishing boundary distance from the Operational Area:** Partially overlaps the Operational Area. **Vessels:** Six active in 2017 (How and Orme, 2019).
Abalone Fishery	✓	✓	X	**Description:** The Western Australian Abalone Fishery includes all coastal waters from the Western Australian and South Australian border to the Western Australian and Northern Territory border. Shark Bay is considered the northern range limit for the commercial abalone species (DoF, 2004) and therefore operates outside of the EMBA. In addition, abalone is harvested by hand using an abalone iron from reefs and rock shelves within Western Australian waters (DoF, 2004), limiting the fishery to shallow waters. The abalone fishery targets the greenlip abalone (*Haliotis laevigata*), brownlip abalone (*H. conicopora*) and Roe's abalone (*H. roei*) (DoF, 2004). The commercial fishery reported a total commercial catch of 49 t in 2017. **Fishing boundary distance from the Operational Area:** Overlaps the Operational Area. **Vessels:** 23 vessels active in Roe's abalone fishery (Strain et al., 2018).

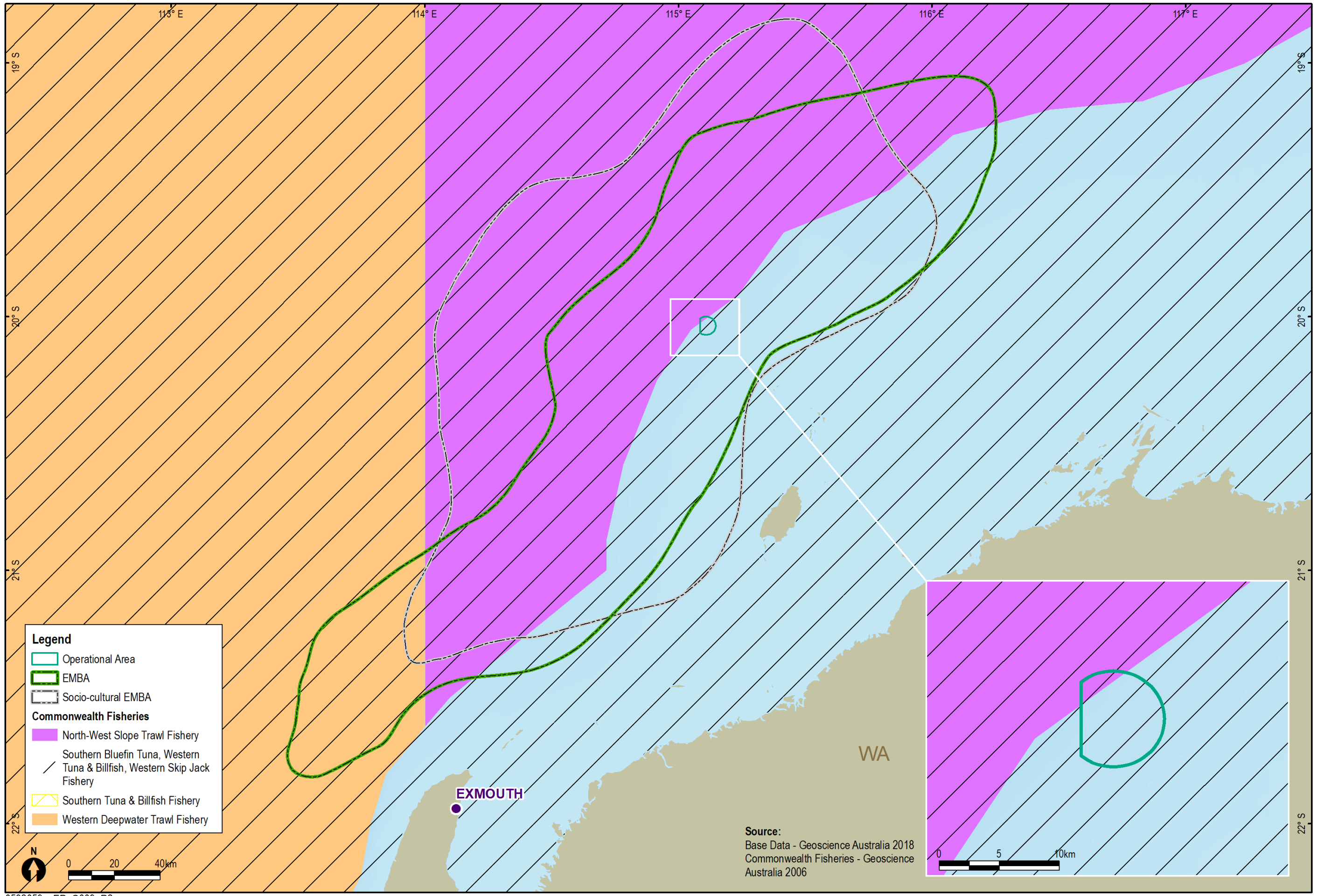


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Figure 4-13: Location of Commonwealth fisheries in relation to the Operational Area

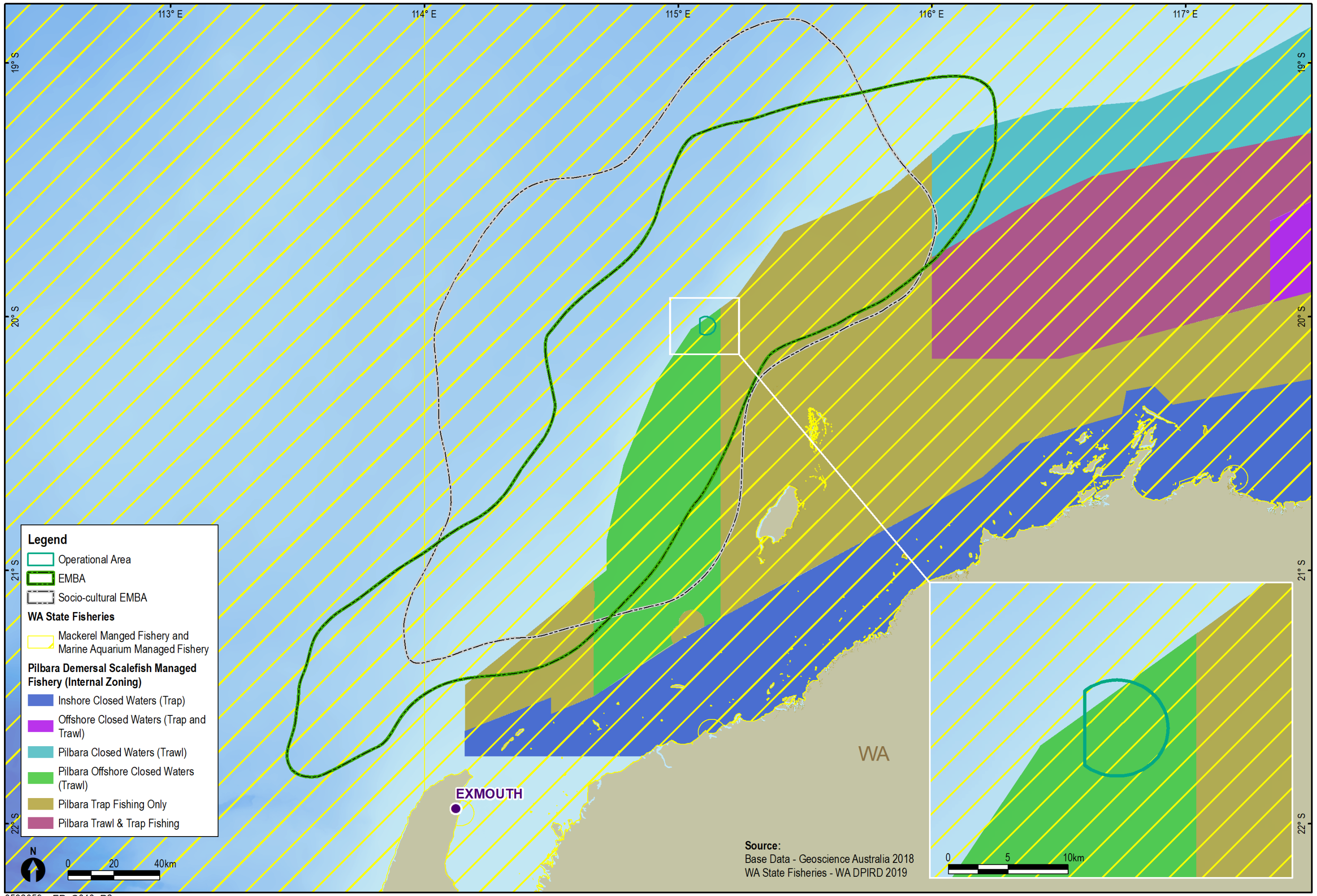

Figure 4-14: Location of State fisheries in relation to the Operational Area (1 of 2)

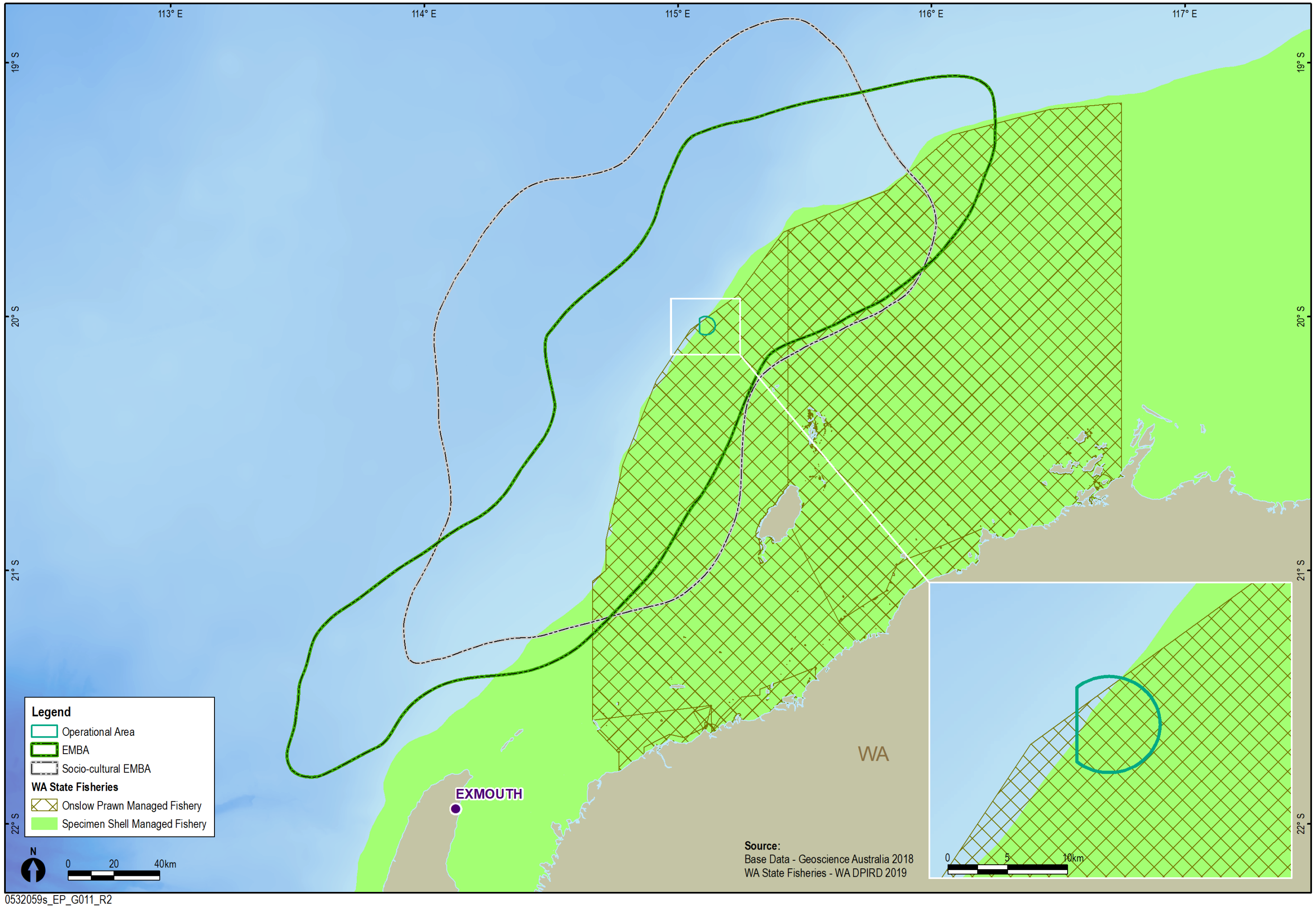

Figure 4-15: Location of State fisheries in relation to the Operational Area (2 of 2)

Aquaculture

There are no aquaculture activities within or adjacent to the Operational Area. Aquaculture in the wider region is typically restricted to shallow coastal waters and consists primarily of culturing hatchery, reared and wild caught oysters (*Pinctada maxima*) for pearl production.

Pearl farm site locations nearest to the Operational Area, but outside the EMBA, are those at the Montebello Islands. In the Gascoyne Coast region, oyster hatcheries are important, with those located in Carnarvon and Exmouth supplying significant quantities of *P. maxima* spat to pearl farms in Exmouth Gulf and Montebello Islands (DoF, 2011). Leases typically occur in shallow coastal waters at depths of less than 20 m (DoF, 2011).

Primary spawning of the pearl oyster occurs from mid-October to December. A smaller secondary spawning occurs in February and March (Fletcher & Santoro, 2012).

4.6.4 Fisheries – Traditional

There are no traditional, or customary, fisheries within the Operational Area, as these are typically restricted to shallow coastal waters and/or areas with structures such as reef. However, it is recognised that Barrow Island, Montebello Islands, Exmouth, Ningaloo Reef and the adjacent foreshores have a known history of fishing when areas were occupied (as from historical records). Areas that are covered by registered native title claims are likely to practice Aboriginal fishing techniques at various sections of the WA coastline.

4.6.5 Tourism and Recreation

No tourism activities take place specifically within the Operational Area but it is acknowledged that there are growing tourism and recreational sectors in WA. These sectors have expanded in area over the last couple of decades. Potential for growth and further expansion in tourism and recreational activities in the Pilbara and Gascoyne regions is recognised, particularly with the development of regional centres and a workforce associated with the resources sector (Gascoyne Development Commission, 2012).

Recreational fishing in the Northwest Shelf Province is mainly concentrated around the coastal waters and islands (including Dampier Archipelago, Ningaloo Marine Park, North West Cape area, the Montebello Islands, and other islands and reefs in the region) (DoF, 2011). It has grown exponentially with the expanding regional centres and increasing residential and fly in/fly out work force, particularly in the Pilbara region. Within the EMBA, occasional recreational fishing occurs at Rankin Bank, located about 40 km north-east of the Operational Area.

4.6.6 Shipping

The region supports commercial shipping activity, the majority of which is associated with the mining and oil & gas industries (Figure 4-16). AMSA has introduced a network of marine fairways on the NWS of WA to reduce the risk of vessel collisions with offshore infrastructure. The fairways are not mandatory but AMSA strongly recommends commercial vessels remain within the fairway when transiting the region. None of these fairways intersect with the Operational Area and only light traffic occurs in the Operational Area as a whole Figure 4-16). Major shipping routes in the area are associated with entering the ports of Dampier and Barrow Island. Shipping activities in the region include:

- international bulk freighters/tankers arriving and departing from Dampier including mineral ore, hydrocarbons (LNG, liquefied petroleum gas, condensate) and salt carriers
- domestic support/supply vessels servicing offshore facilities and Barrow Island development
- construction vessels/barges/dredges
- offshore survey vessels.

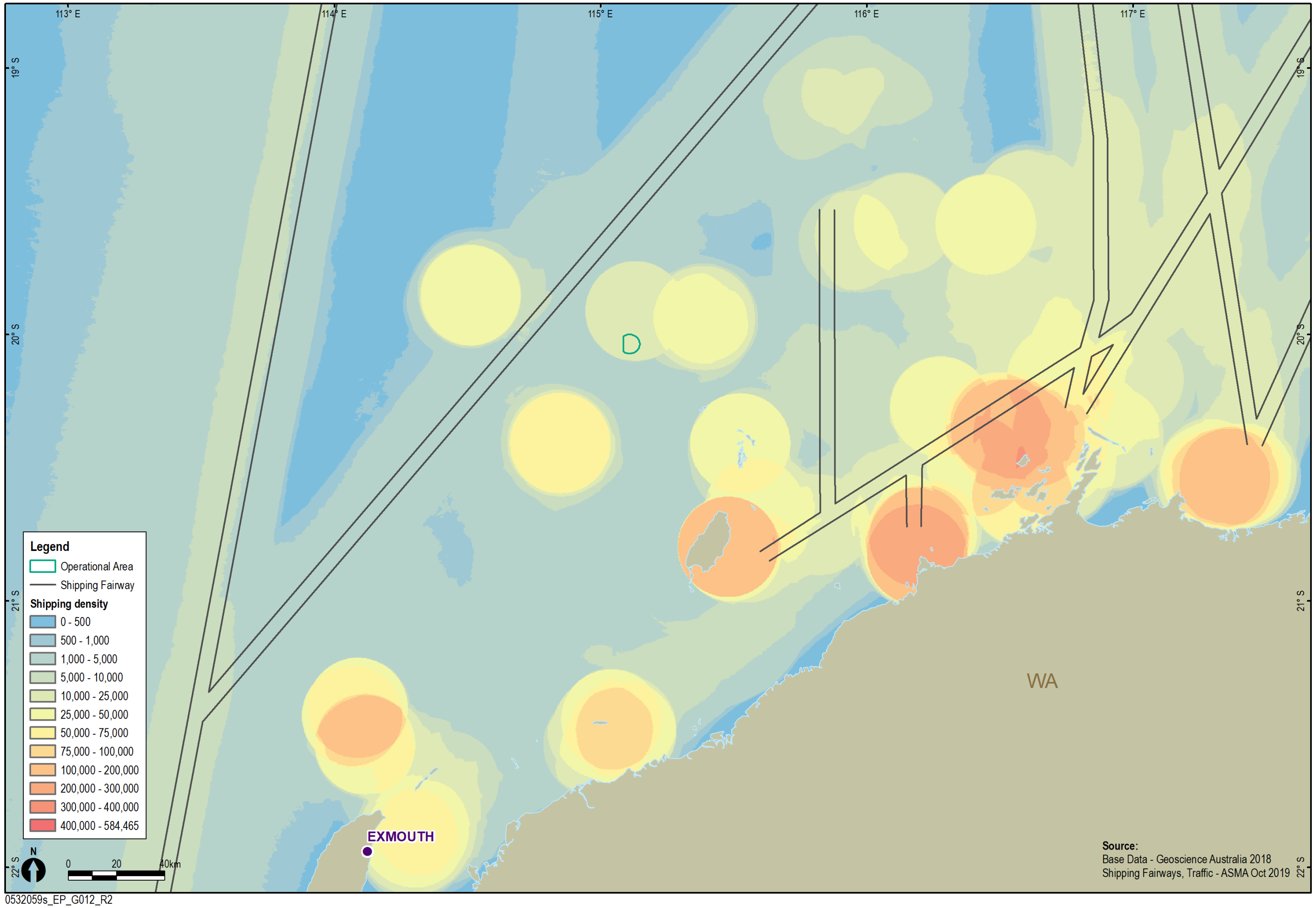

Figure 4-16: Vessel density map for the Operational Area from 2013, derived from AMSA satellite tracking system data

4.6.7 Existing Oil and Gas Infrastructure

The Operational Area is located within an area of established oil and gas operations, with additional infrastructure in the broader NWS region (Figure 3-1). Table 4-8 details other facilities located in proximity to the Operational Area.

Adjacent to the Operational Area, Woodside's Julimar Development Phase 2 is anticipated to commence in Q4 2019 and be completed in 2022. This development will include subsea infrastructure installation, including wellheads, umbilicals and production flowlines. Six abandoned appraisal wells with wellheads are also located in Permit Area WA-49-L.

Table 4-8: Other oil and gas operations located within the area

Facility name and operator	Approximate distance from Operational Area	Direction
Pluto Platform (Woodside)	23 km	East-north-east
Wheatstone Platform (Chevron)	27 km	North-east
John Brookes (Quadrant Energy, now Santos)	35 km	South
East Spar (Quadrant Energy, now Santos)	61 km	South
Goodwyn (Woodside)	91 km	North-east
North Rankin (Woodside)	113 km	North-east

4.6.8 Defence

There are designated defence practice areas in the offshore marine waters off the North West Cape in the EMBA. The Operational Area lies within the northern tip of one of these defence practice areas, the Royal Australian Air Force Base Learmonth (Figure 4-17). The closest site where unexploded ordinance is known to occur is 8 km east of Trimouille Island in depths of about 40 m, located about 75 km south east of the Operational Area.

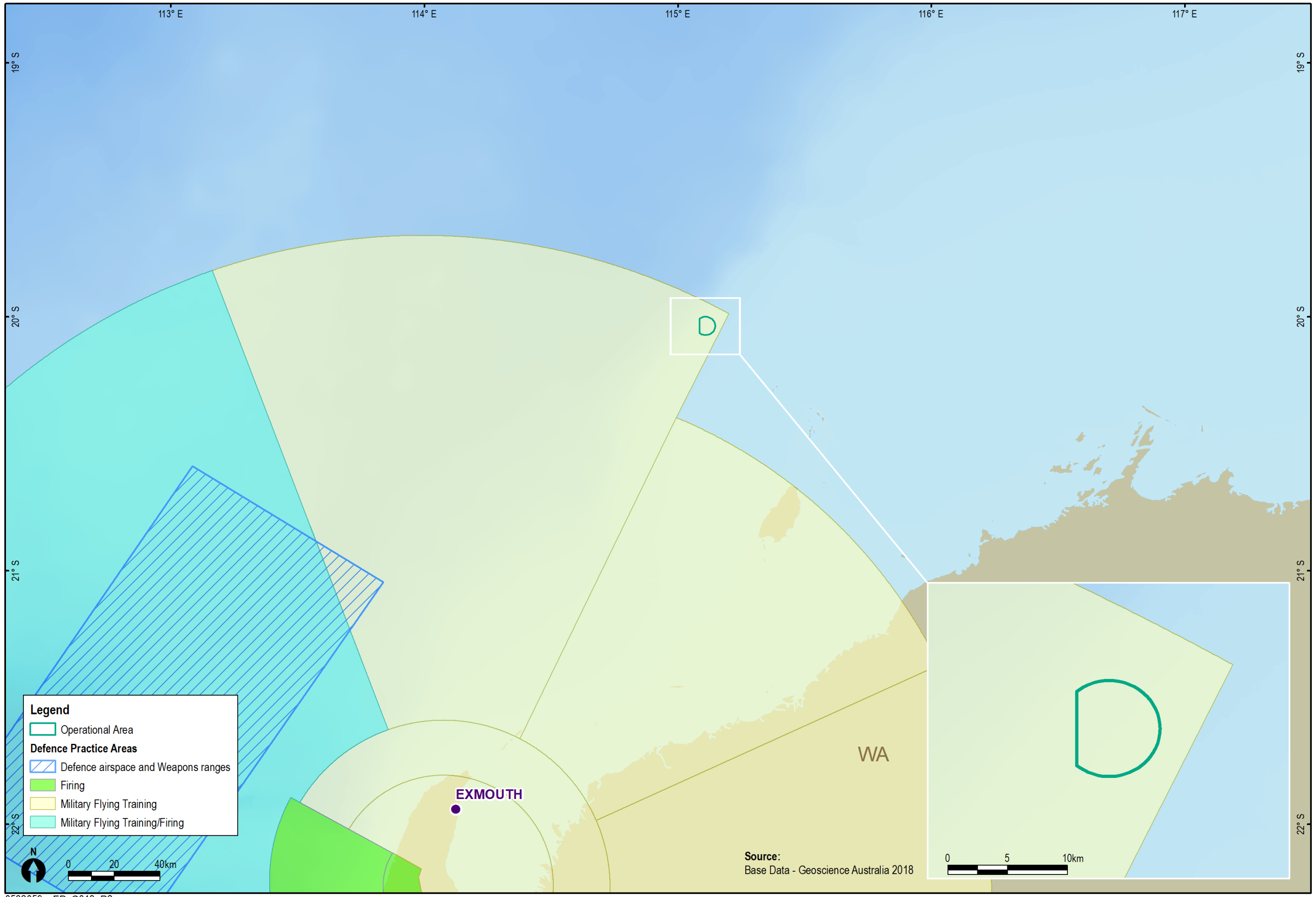

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Figure 4-17: Department of Defence demarcated marine offshore areas for military and defence practice with reference to the location of the Operational Area

4.7 Values and Sensitivities

The values and sensitivities of the Operational Area and wider regional perspective are presented in this section.

The nearest habitat of significant conservation value to the Operational Area is the Continental Slope Demersal Fish Communities KEF, which spatially overlaps the Operational Area. The conservation and environmental values of this KEF are detailed in Section 4.7.3.

In close proximity to the Operational Area is the Ancient Coastline at 125 m Depth Contour KEF (Table 4-9). The offshore environment of the Northwest Shelf Province contains environment (such as habitat and species) of high value or sensitivity including Commonwealth offshore waters, as well as the wider regional context including coastal waters and habitats such as the Montebello/Barrow/Lowendal Island Group. Sensitivities include the associated resident, temporary or migratory marine life including EPBC Act species such as marine mammals, turtles and birds. The marine environment of these offshore locations is pristine and many sensitive receptor locations are protected as part of Commonwealth and State managed areas, including the 2017 proclaimed network of North-west Marine Bioregion AMPs. The location of AMPs in relation to the Operational Area and EMBA are illustrated in Figure 4-18.

The following section outlines the values and sensitivities of the established Marine Protected Areas (MPAs) and other sensitive areas in the wider regional environmental setting (listed in Table 4-9) that may be impacted by the Petroleum Activities Program (planned and unplanned).

Table 4-9: Summary of MPAs and other sensitive locations in the region relating to the Operational Area

	Distance from Operational Area to values/sensitivity boundaries (km)	International Union for Conservation of Nature (IUCN) Protected Area Category
Established Australian Marine Parks		
Montebello AMP	11	VI – Multiple Use Zone
Gascoyne AMP	156	II – Marine National Park Zone IV – Habitat Protection Zone VI – Multiple Use Zone
Established State Marine Parks		
Nil	N/A	N/A
KEFs		
Continental Slope Demersal Fish Communities	Overlaps	N/A
Ancient Coastline at 125 m Depth Contour	4	N/A
Canyons Linking the Cuvier Abyssal Plain and the Cape Range Peninsula	157	N/A
Other Sensitivities		
Rankin Bank	40	N/A

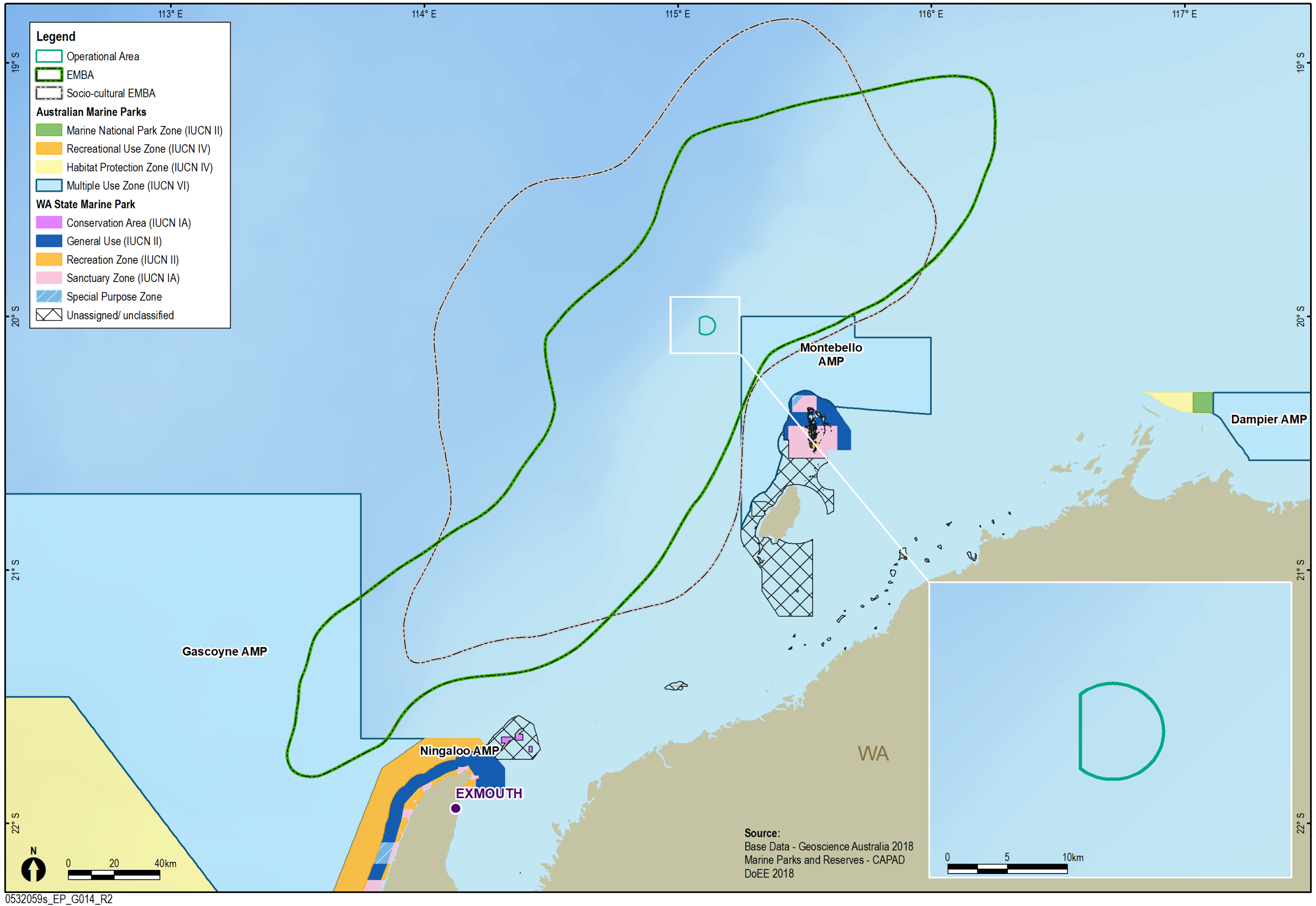

Figure 4-18: Commonwealth and State MPAs in relation to the Operational Area

4.7.1 Montebello Australian Marine Park

The Montebello AMP covers about 3413 km² and ranges in depth from less than 15 to 150 m. At its closest point, the Montebello Marine Park lies about 11 km east of the Operational Area (Figure 4-18). The AMP lies about 20 km north of Barrow Island and 125 km west of Dampier, and contains several natural values including:

- foraging and staging areas adjacent to important breeding areas for migratory seabirds
- breeding habitat for seabirds (includes the largest breeding population of roseate terns in WA) (DSEWPaC, 2012d)
- foraging areas for Vulnerable and Migratory whale sharks
- foraging areas adjacent to important nesting sites for marine turtles
- part of the migratory pathway and resting area of the protected humpback whale (DSEWPaC, 2012e)
- heritage site the wreck of the *Trial* – the earliest known shipwreck in Australian waters (Director of National Parks, 2013)
- one KEF for the region, the Ancient Coastline at 125 m Depth Contour (Section 4.7.3).

The AMP includes shallow shelf environments and provides protection for shelf and slope habitats, as well as pinnacle and terrace seabed features. Examples of the seabed habitats and communities of the NWS as well as the Pilbara (offshore) meso-scale bioregion (Heap et al., 2005) are found within the Marine Park. The Montebello Marine Park also includes a small portion of the Ancient Coastline at 125 m Depth Contour KEF, which is a unique seabed feature that provides areas of enhanced biological productivity.

The Montebello AMP is zoned as a multiple use zone (IUCN VI), allowing for long-term protection and maintenance of the AMP in conjunction with sustainable use, including oil and gas exploration activities. The AMP is contiguous with the existing Montebello Marine Park in State waters.

4.7.2 Gascoyne Australian Marine Park

The Gascoyne AMP covers about 81,766 km² and includes waters from less than 15 m depth to 6000 m depth. The Gascoyne AMP lies about 156 km south west of the Operational Area but within the EMBA. Natural values identified within the AMP include:

- foraging areas for migratory seabirds (including the wedge-tailed shearwater), hawksbill and flatback turtles and whale sharks
- a continuous connectivity corridor from 15 to over 5000 m
- seafloor features including canyon, terrace, ridge, knolls, deep hole/valley and continental rise
- sponge gardens in the south of the reserve adjacent to Western Australian coastal waters
- examples of the ecosystems of the Central Western Shelf Transition, the Central Western Transition and the North West Province provincial bioregions as well as the Ningaloo meso-scale bioregion (Director of National Parks, 2013).

The AMP contains four KEFs for the region:

1. Canyons on the slope between the Cuvier Abyssal Plain and the Cape Range Peninsula (associated enhanced productivity, aggregations of marine life and unique sea-floor feature).
2. Exmouth Plateau (unique seafloor feature associated with internal wave generation).

3. Continental slope demersal fish communities (high species diversity and endemism which is the most diverse slope bioregion in Australia with over 500 species recorded of which 76 are endemic to the area).
4. Commonwealth waters adjacent to Ningaloo Reef—an area where the Leeuwin and Ningaloo currents interact resulting in enhanced productivity and aggregations of marine life.

The AMP boundary is adjacent to the existing Commonwealth portion of the Ningaloo Marine Park.

4.7.3 Key Ecological Features

KEFs were identified in the Operational Area and EMBA using the EPBC Protected Matters Search Tool (Appendix C). Figure 4-19 shows these features in relation to the Operational Area.

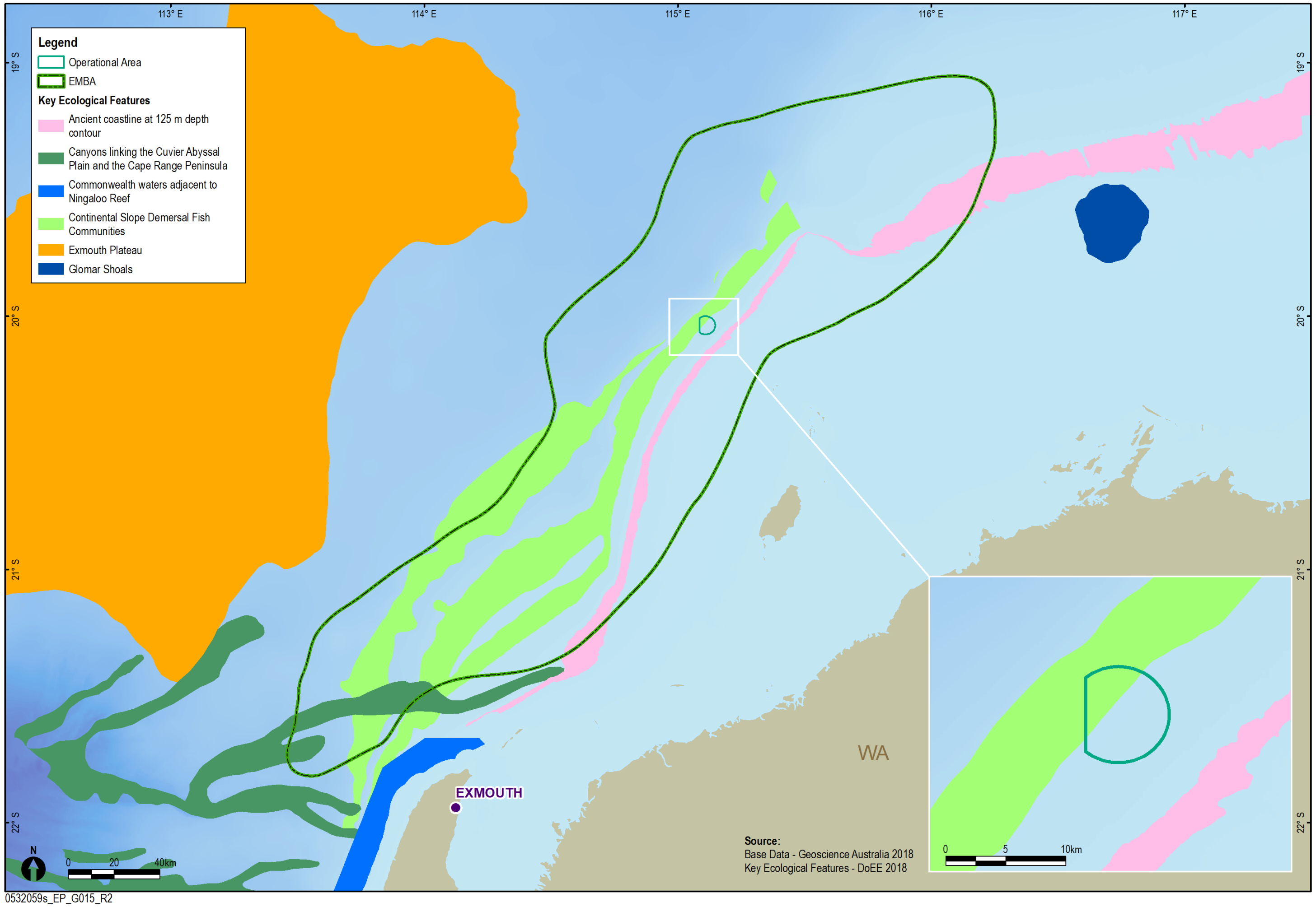

Figure 4-19: KEFs in relation to the Operational Area

4.7.3.1 Key Ecological Features within the Operational Area

Continental Slope Demersal Fish Communities

The continental slope demersal fish communities in the region have been identified as a KEF of the Northwest Shelf Province (DoEE, 2019) (Appendix C), and overlaps with the north-west extent of the Operational Area. The continental slope between North West Cape and the Montebello Trough has been identified as one of the most diverse slope assemblages in Australian waters, with over 508 fish species and the highest number of endemic species (76) of any Australian slope habitat (DEWHA, 2008a). Additional features relating to the fish populations of this area are as follows:

- Continental slope demersal fish communities of the NWS Province have been identified as a KEF of the NWMR due to the notable diversity of the demersal fish assemblages and high levels of endemism (DoEE, 2019).
- The North West Cape marine region is a transition area for demersal shelf and slope fish communities between the tropical dominated communities to the north and temperate communities to the south (Last et al., 2005). The benthic shelf and slope communities offshore of the North West Cape comprise both tropical and temperate fish species with a north-south gradient (DEWHA, 2008).
- The fish fauna of the North West Cape area, like the ichthyofauna of many regions, exhibits decreasing species richness with depth (Last et al., 2005). Fish species diversity has been shown to be positively correlated with habitat complexity, with more complex habitats (e.g. coral reefs) typically hosting higher species richness than simpler habitats such as bare, unconsolidated muddy sediments (Gratwicke & Speight, 2005). The offshore sediment habitats of the Operational Area are expected to support lower fish species richness than other shallower, more complex habitats in the coastal areas of the region.

4.7.3.2 Key Ecological Features within the EMBA

Ancient Coastline at the 125 m Depth Contour (KEF)

Located 4 km south-east of the Operational Area, the ‘ancient coastline at 125 m depth contour’ is defined as the depth range 115–135 m in the Northwest Shelf Province and NWS Transition provincial bioregions (Figure 4-19). Several steps and terraces as a result of Pleistocene sea level changes occur in the region, with the most prominent of these features occurring as an escarpment along the NWS and Sahul Shelf at a water depth of 125 m. The ancient coastline is not continuous and is fragmented along the 125 m depth contour. Where the ancient submerged coastline provides areas of hard substrate, it may contribute to higher diversity and enhanced species richness relative to soft sediment habitat (DEWHA, 2008a).

The ancient submerged coastline is an important divide between carbonate, cemented sands and the fine, less cemented slope materials offshore. It is valued as a unique seafloor feature with ecological properties of regional significance. Parts of the ancient coastline, represented as rocky escarpment, are considered to provide biologically important habitat in an area predominantly made up of soft sediment. The escarpment type features may also potentially facilitate mixing within the water column due to upwelling, providing a nutrient rich- environment.

Canyons Linking the Cuvier Abyssal Plain with the Cape Range Peninsula

The canyons that link the Cuvier Abyssal Plain with the Cape Range Peninsula lie off the north-west coast of Australia, over 157 km south-west of the Operational Area but within the EMBA. The canyons are believed to support the productivity and species richness of Ningaloo Reef (Commonwealth of Australia, 2012). Interactions with the Leeuwin current and strong internal tides are thought to result in upwelling at the canyon heads, thus creating conditions for enhanced productivity in the region (Brewer et al., 2007). As a result, aggregations of whale sharks, manta rays, humpback whales, seasnakes, sharks, predatory fish and seabirds are known to occur in the area due to the enhanced productivity (Sleeman et al., 2007).

4.7.4 Rankin Bank

Rankin Bank is on the continental shelf, about 40 km north-east of the Operational Area and within the EMBA. While Rankin Bank is not protected and is not a KEF, along with Glomar Shoal it is the only large, complex bathymetrical feature on the outer western shelf of the West Pilbara and represents habitats that are likely to play an important role in the productivity of the Pilbara region (AIMS, 2014). Rankin Bank consists of three submerged shoals delineated by the 50 m depth contour with water depths of about 18–30.5 m (AIMS, 2014; Abdul Wahab et al 2018).

Rankin Bank, along with Glomar Shoal, was surveyed by AIMS in 2013 as part of a co-investment project between Woodside and AIMS to better understand the habitats and complexity of the submerged shoal ecosystems. Rankin Bank represents a diverse marine environment, predominantly composed of consolidated reef and algae habitat (~55% cover), followed by hard corals (~25% cover), unconsolidated sand/silt habitat (~16% cover), and benthic communities composed of macroalgae, soft corals, sponges and other invertebrates (~3% cover) (AIMS, 2014). Hard corals are a significant component of the benthic community of some parts of the bank, with abundance in the upper end of the range observed elsewhere on the submerged shoals and banks of North West Australia (Heyward et al., 2011).

In shallower reef habitats (20–30 m depth), patches of high coral cover (exceeding 80%) extended for lengths up to 500 m, although patches with cover of 40–50% extending for shorter lengths (40–70 m) were more common (AIMS, 2014). Extensive hard coral habitats were also present in deeper waters (40–80 m), where the solitary mushroom coral *Diaseris* sp. formed large beds, some extending for more than a kilometre with an average of about 50% cover (AIMS, 2014; Abdul Wahab et al., 2018).

Overall, Rankin Bank has a higher cover of hard corals, macroalgae and unconsolidated reef than Glomar Shoal. Hard coral communities were more diverse at Rankin Bank (33 genera) than at Glomar Shoal (21 genera) but soft corals were more diverse at Glomar Shoal than at Rankin Bank (AIMS, 2014; Abdul Wahab et al., 2018).

Other key characteristics of the Rankin Bank include:

- The fish abundance and diversity of the demersal fish communities of Rankin Bank are comparable with other regional Australian reefs and the NW submerged shoals and banks.
- Over 200 fish species were recorded at Rankin Bank and were generally classified as reef associated- species including surgeonfishes, emperors and coronation trout (AIMS, 2014).
- Species richness and abundance were influenced by depth, with shallower areas (<40 m) supporting the most species and highest number of individuals found in <20 m.

Sediment at Rankin Bank is predominantly sand, with an increase in mud at deeper, more protected areas (AIMS, 2014). Sediment quality is considered pristine and unpolluted by anthropogenic impacts (AIMS, 2014).

5 STAKEHOLDER CONSULTATION

5.1 Summary

Woodside is committed to consulting relevant stakeholders to ensure stakeholder feedback informs its decision making and planning for proposed petroleum activities and builds upon Woodside's extensive and ongoing stakeholder consultation for its offshore petroleum activities in the region.

5.2 Stakeholder Consultation Guidance

Woodside has followed the requirements of Subregulation 11A (1) of the Environment Regulations to identify relevant stakeholders, these being:

- Each Department or agency of the Commonwealth Government to which the activities to be carried out under the Environment Plan, or the revision of the Plan, may be relevant.
- Each Department or agency of a State or the NT Government to which the activities to be carried out under the Environment Plan, or the revision of the Plan, may be relevant.
- The Department of the responsible State Minister, or the responsible NT Minister.
- 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 Plan.
- Any other person or organisation that the Titleholder considers relevant.

Woodside's assessment of stakeholder relevance is outlined in Table 5 1.

5.3 Stakeholder Consultation Objectives

In support of this EP, Woodside has sought to:

- Ensure all relevant stakeholders are identified and engaged in a timely and effective manner.
- Develop and make available communications material to stakeholders that is relevant to their interests and information needs.
- Incorporate stakeholder feedback into the management of the proposed activity where practicable.
- Provide feedback to stakeholders on Woodside's assessment of their feedback and keep a record of all engagements.
- Make available opportunities to provide feedback during the life of this EP.

5.4 Stakeholder Expectations for Consultation

Stakeholder consultation for this activity has also been guided by stakeholder organisation expectations for consultation on planned activities. This guidance includes:

NOPSEMA:

- *GL1721 - Environment plan decision making - Rev 5 - June 2018*
- *GN1847 - Responding to public comment on environment plans - Rev 0 - April 2019*
- *GN1344 - Environment plan content requirements - Rev 4 - April 2019*
- *GN1488 - Oil pollution risk management - Rev 2 - February 2018*

Commonwealth Government:

- *Offshore Petroleum and Greenhouse Gas Activities: Consultation with Australian Government agencies with responsibilities in the Commonwealth Marine Area*

AFMA:

- *Petroleum industry consultation with the commercial fishing industry*

Commonwealth Department of Agriculture and Water Resources

- *Fisheries and the Environment – Offshore Petroleum and Greenhouse Gas Act 2006*
- *Offshore Installations Biosecurity Guide*

WA Department of Primary Industries and Regional Development

- *Guidance statement for oil and gas industry consultation with the Department of Fisheries*

WA Department of Transport

- *Offshore Petroleum Industry Guidance Note*

Woodside acknowledges that additional relevant stakeholders may be identified prior to or during the proposed activity. These stakeholders will be contacted, provided relevant information to their interests and invited to provide feedback about the proposed activity. Woodside will assess their feedback, respond to the stakeholder and incorporate feedback into the management of the proposed activity where practicable.

Woodside consultation arrangements typically provide stakeholders up to 30 days (unless otherwise agreed) to review and respond to proposed activities where stakeholders are potentially affected. Woodside considers this consultation period an adequate timeframe in which stakeholders can assess potential impacts of the proposed activity and provide feedback.

Table 5-1: Assessment of relevant stakeholders for the proposed activity

Stakeholder	Relevant to activity	Reasoning
Commonwealth Government department or agency		
Australian Customs Service - Border Protection Command (ACS)	Yes	Responsible for coordinating maritime security.
Australian Fisheries Management Authority (AFMA)	Yes	Responsible for the management of Commonwealth fisheries. No potential for interaction with Commonwealth fisheries in the Operational Area.
Australian Hydrographic Office (AHO)	Yes	Response for maritime safety and Notice to Mariners.
Australian Maritime Safety Authority (AMSA)	Yes	Statutory agency for vessel safety and navigation and legislated responsibility for oil pollution response in Commonwealth waters. Proposed activity has a hydrocarbon spill risk, which may require AMSA assistance for pollution response.
Department of Agriculture and Water Resources (DAWR)	Yes	Responsible for implementing Commonwealth policies and programmes to support the agriculture, fisheries, food and forestry industries. The proposed activity has the potential impact to DAWR's interests in the prevention of introduced marine species. No impacts are expected on commercial fishing operators licenced to fish in Commonwealth Fisheries that would impact the functions, interests or activities of DAWR.
Department of Defence (DoD)	Yes	Responsible for defending Australia and its national interests. The proposed Operational Area overlaps the Defence training area.
Department of the Environment and Energy (DoEE)	No	Responsible for designing and implementing Australian Government policy and programs to protect and conserve the environment, water and heritage, promote climate action, and provide adequate, reliable and affordable energy. The proposed activity does not trigger any of the DoEE's functions, interests or activities.
Department of Industry, Innovation and Science (DIIS)	Yes	Department of relevant Commonwealth Minister and is required to be consulted under the Regulations.
Director of National Parks (DNP)	No	Responsible for the management of Commonwealth parks and conservation zones. Whilst planned activities do not affect the functions, interests or activities of the DNP, Woodside has chosen to provide information on arrangements for unplanned events, such as an oil spill, which have potential to impact the values within a Commonwealth marine park.
WA Government department or agency		
Department of Biodiversity, Conservation and Attractions (DBCA)	No	Responsible for the management of Western Australia's parks, forests and reserves. Planned activities do not impact DBCA's functions, interests or activities.
Department of Mines, Industry Regulation and Safety (DMIRS)	Yes	Department of relevant State Minister and is required to be consulted under the Regulations.

Stakeholder	Relevant to activity	Reasoning
Department of Primary Industries and Regional Development (DPIRD)	Yes	Responsible for the management of State fisheries. Potential for interaction during proposed activities with State fisheries in the Operational Area.
Department of Transport (DoT)	No	Legislated responsibility for oil pollution response in State waters. Proposed activity does not pose a hydrocarbon spill risk that would require DoT response in State waters.
Commonwealth fisheries*		
North-West Slope Trawl Fishery	Yes	The fishery overlaps the Operational Area and there is potential for interaction with licence holders.
Southern Bluefin Tuna Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
Western Tuna and Billfish Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
Western Skipjack Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
State fisheries*		
Abalone Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
Beche-de-mer Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
Mackerel Managed Fishery – Pilbara (Area 2)	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
Marine Aquarium Managed Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
Onslow Prawn Managed Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
Pearl Oyster Managed Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
Pilbara Demersal Scalefish Fishery - Pilbara Trawl Fishery - Pilbara Trap Fishery - Pilbara Line Fishery	 No Yes Yes	 The Operational Area is outside of the Pilbara Trawl Fishery. The Operational Area is outside of the Pilbara Trap Fishery. The fishery overlaps the Operational Area and DPIRD data indicates active fishing within the Operational Area.

Stakeholder	Relevant to activity	Reasoning
South West Coast Salmon Managed Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
Specimen Shell Managed Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
West Coast Deep Sea Crustacean Managed Fishery	No	Whilst the fishery overlaps the Operational Area, the fishery has not been active in the Operational Area within the last five years.
Industry		
Chevron	Yes	Adjacent Titleholder
Industry representative organisations		
Australian Petroleum Production and Exploration Association (APPEA)	Yes	Represents the interests of oil and gas explorers and producers in Australia.
Commonwealth Fisheries Association (CFA)	Yes	Represents the interests of commercial fishers with licences in Commonwealth waters. No potential for interaction with Commonwealth fisheries in the Operational Area.
Pearl Producers Association (PPA)	Yes	Although interactions with licence holders in the Pearl Oyster Managed Fishery are unlikely, PPA has requested to be informed of Woodside's planned activities.
Recfishwest	No	Represents the interests of recreational fishers in Western Australia. Recfishwest has provided feedback for previous consultation for activities in WA-49-L that interaction with recreational fishers is unlikely given the distance from shore.
Western Australian Fishing Industry Council (WAFIC)	Yes	Represents the interests of commercial fishers with licences in State Waters. There is potential for interaction with commercial fishers in the Pilbara Line Fishery.

** Fisheries have been identified as being relevant on the basis of fishing licence overlap with the proposed Operational Area, as well as consideration of fishing effort data, fishing methods and water depth. Table 4-7 provides a detailed assessment of Commonwealth and State fisheries within or adjacent to the Operational Area.*

5.5 Stakeholder Consultation

Consultation activities conducted for the proposed activity are outlined in Table 5-2. The Consultation Information Sheet (Appendix F) is published on the Woodside website and includes a toll free 1800 phone number.

Table 5-2: Stakeholder consultation plan activities

Stakeholder	Information provided	Stakeholder response	Woodside response
Australian Government department or agency			
ACS	On 18 November 2019 Woodside emailed ACS advising of the proposed activity and provided a consultation Information Sheet (Appendix F, reference 1.1)	No feedback received.	Woodside has addressed maritime security-related issues in Section 6 of this EP based on previous offshore activities. Woodside considers the level of consultation to be adequate.
AFMA	On 19 November 2019 Woodside emailed AFMA advising of the proposed activity (Appendix F, reference 1.5) and provided a Commonwealth Fisheries map (Appendix F, reference 1.6) relevant to the proposed activity and a consultation Information Sheet.	No feedback received.	Email, consultation Information Sheet and Commonwealth fisheries map provided. Woodside considers the level of consultation to be adequate.
AHO	On 18 November 2019 Woodside emailed AHO advising of the proposed activity (Appendix F, reference 1.13) and provided a shipping fairways map (Appendix F, reference 1.14) and a consultation Information Sheet.	No feedback received.	Based on feedback from AMSA, on previous Environment Plans, Woodside will notify the AHO no less than four working weeks before operations commence.
AMSA (marine safety)	On 18 November 2019 Woodside emailed AHO advising of the proposed activity (Appendix F, reference 1.15) and provided a shipping fairways map (Appendix F, reference 1.14) and a consultation Information Sheet.	On 21 November 2019 AMSA emailed Woodside requesting the Master to email AMSA's Joint Rescue Coordination Centre at least 24–48 hours before operations commence and provided details of information required by the Centre in that communication. AMSA requested that the AHS be contacted through datacentre@hydro.gov.au no less than four working weeks before operations commence for the promulgation of related notices to mariners. AMSA provided advice on obtaining vessel traffic plots, including digital data sets and maps.	Woodside will notify AMSA's Joint Rescue Coordination Centre at least 24–48 hours before operations commence for each survey. Woodside will notify the AHO no less than four working weeks before operations commence. Woodside notes AMSA's advice on vessel traffic information.
AMSA (marine pollution)	On 18 November 2019 Woodside emailed AMSA advising on its consultation approach for the Oil Pollution First Strike Plan consultation Information Sheet (Appendix F, reference 1.13).	No feedback received.	No response required.

Stakeholder	Information provided	Stakeholder response	Woodside response
	On 22 November 2019 Woodside emailed AMSA a copy of the Oil Pollution First Strike Plan (Appendix F, reference 1.16).	No feedback received.	Email, consultation Information Sheet and first strike plan provided. Woodside considers the level of consultation to be adequate.
DAWR	On 18 November 2019 Woodside emailed DAWR advising of the proposed activity and provided information on invasive marine species (Appendix F, reference 1.11), a Commonwealth Fisheries map (Appendix F, reference 1.12) and a consultation Information Sheet.	No feedback received.	Woodside has addressed maritime biosecurity and Commonwealth fishing related issues in Section 6 of this EP based on previous offshore activities. Woodside considers the level of consultation to be adequate.
DoD	On 18 November 2019 Woodside emailed DoD advising of the proposed activity (Appendix F, reference 1.7) and provided a defence map (Appendix F, reference 1.8) and a consultation Information Sheet.	No feedback received.	Email, consultation Information Sheet and defence map provided. Woodside considers the level of consultation to be adequate.
DIIS	On 18 November 2019 Woodside emailed DIIS advising of the proposed activity (Appendix F, reference 1.1) and provided a consultation Information Sheet.	No feedback received.	Email and Consultation Information Sheet provided. Woodside considers the level of consultation to be adequate.
DNP	On 19 November 2019 Woodside emailed DNP advising of the proposed activity and provided a consultation Information Sheet (Appendix F, reference 1.17)	On 17 December 2019 DNP emailed Woodside confirming that no authorisation requirements were required as activities were planned to take place outside of a national park. DNP also noted an error in Woodside's communication material with respect to the distance of the activity from the Montebello Marine Park. DNP confirmed that it did not require further notification of activity progress unless details regarding the activity change and result in an overlap with or new impact to a marine park, or for emergency responses.	Woodside notes DNP's advice. Woodside acknowledges the error, noting that the correct distance is outside of a national park and does not impact the DNP's interests or activities. Woodside notes DNP's advice.
Western Australian Government department or agency or advisory body			
DMIRS	On 18 November 2019 Woodside emailed DMIRS advising of the proposed activity and provided a consultation Information Sheet (Appendix F, reference 1.1).	No Feedback received.	Email and Consultation Information Sheet provided. Woodside considers the level of consultation to be adequate.

Stakeholder	Information provided	Stakeholder response	Woodside response
DPIRD	On 19 November 2019 Woodside emailed DPIRD advising of the proposed activity (Appendix F, reference 1.3) and provided a State Fisheries map relevant to the proposed activity (Appendix F, reference 1.4) and a consultation Information Sheet	No feedback received.	Woodside to undertake follow-up consultation.
	On 25 November 2019 Woodside called DPIRD and sought feedback on a number of EP consultation activities, including this EP. On 25 November 2019 Woodside emailed DPIRD providing information on EPs currently under consultation.	On 25 November 2019 DPIRD thanked Woodside by way of an email response.	Woodside has attempted on a number of occasions to contact and consult DPIRD via email and phone calls and considers the level of consultation appropriate.
DoT	On 18 November Woodside emailed DoT advising on its consultation approach for the Oil Pollution First Strike Plan consultation Information Sheet (Appendix F, reference 1.15)	On 9 December 2019 DoT emailed Woodside noting Woodside's advice and would review the First Strike Plan once submitted.	No further action.
	On 10 December 2019 Woodside emailed DoT, noting that oil spill modelling predicted no impact above any response threshold in State waters or on shorelines. A copy of the First Strike Plan was provided for reference.	No feedback received.	No further action as oil spill modelling predicts no impact above any threshold that would require DoT response.
Commonwealth Fisheries			
North West Slope Trawl Fishery	On 19 November 2019 November Woodside emailed licence holders in the North West Slope Trawl fishery advising of the proposed activity (Appendix F, reference 1.5) and provided a State Fisheries map relevant to proposed activity (Appendix F, reference 1.6) and a consultation Information Sheet	No feedback received.	Email, consultation Information Sheet and Commonwealth fisheries map provided. Woodside considers the level of consultation to be adequate.
State Fisheries			
Pilbara Line Fishery Pilbara Trap Fishery	On 19 November 2019 November Woodside emailed licence holders in the Pilbara Line and Trap Fisheries advising of the proposed activity (Appendix F, reference 1.3) and provided a State Fisheries map relevant to proposed activity (Appendix F, reference 1.4) and a consultation Information Sheet	No feedback received.	Email, consultation Information Sheet and State fisheries map provided. Woodside considers the level of consultation to be adequate.
Industry			
Chevron	On 18 November 2019 November 2019 Woodside emailed Chevron advising of the	No feedback received.	Email, titles map and consultation Information Sheet provided. Woodside

Stakeholder	Information provided	Stakeholder response	Woodside response
	proposed activity (Appendix F, reference 1.9) and provided a titles map relevant to the proposed activity (Appendix F, reference 1.10) and a consultation Information Sheet.		considers the level of consultation to be adequate.
Industry representative organisations			
APPEA	On 18 November 2019 Woodside emailed APPEA advising of the proposed activity (Appendix F, reference 1.1) and provided a consultation Information Sheet.	No feedback received.	Email and consultation Information Sheet provided. Woodside considers the level of consultation to be adequate.
PPA	On 19 November 2019 November 2019 Woodside emailed PPA advising of the proposed activity (Appendix F, reference 1.3) and provided a State Fisheries map relevant to the proposed activity (Appendix F, reference 1.4) and a consultation Information Sheet.	No feedback received.	Email, State Fisheries map and consultation Information Sheet provided. Woodside considers the level of consultation to be adequate.
WAFIC	On 19 November 2019 November 2019 Woodside emailed WAFIC advising of the proposed activity (Appendix F, reference 1.3) and provided a State Fisheries map relevant to the proposed activity (Appendix F, reference 1.4) and a consultation Information Sheet.	WAFIC advised that the only potentially affected fishery was the Pilbara Line fishery.	Woodside emailed on 19 November 2019 a State Fisheries map and consultation Information Sheet to Pilbara Line fishery licence holders.

6 ENVIRONMENTAL RISK ASSESSMENT, PERFORMANCE OUTCOMES, STANDARDS AND MEASUREMENT CRITERIA

6.1 Overview

This section presents the environmental impact and risk analysis, evaluation and environment performance outcomes, environmental performance standards and measurement criteria for the Petroleum Activities Program, using the methodology described in Section 2 of the EP.

6.2 Impact and Risk Analysis and Evaluation

As required by Regulations 13(5) and 13(6) of the Environment Regulations, the following analysis and evaluation demonstrates that the identified impacts and risks associated with the Petroleum Activities Program are reduced to ALARP, are of an acceptable level and consider all operations of the activity, including potential emergency conditions. The impact assessment for planned activities has been based on the size of the Operational Area, which encompasses a radius of 4000 m from the proposed Gemtree-A well centre, within the WA-49-L Permit Area (as described in Section 3.3).

Potential impacts and risks were identified during an ENVID workshop (including decision type, current risk level, acceptability of impacts and risks, and tools used to demonstrate acceptability and ALARP) and have been divided into two broad categories:

- planned activities (routine and non-routine) which have the potential for inherent environmental impacts
- unplanned events (accidents, incidents or emergency situations) with an environmental consequence are termed risks.

Within these categories, impact and risk assessment groupings are based on environmental aspects[5] e.g. emissions, physical presence, etc. In all cases, the worst case impact and risk was assumed.

The ENVID (performed in accordance with the methodology described in Section 2) identified 12 sources of environmental impacts and risks. A summary of the ENVID is provided in Table 6-1.

The impact and risk analysis and evaluation for the Petroleum Activities Program indicate that all current environmental impacts and risks associated with the activity are reduced to ALARP and are of an acceptable level, as discussed further in Sections 6.6 and 6.7.

6.2.1 Cumulative Impacts

Woodside has assessed the cumulative impacts of the Petroleum Activities Program in relation to other relevant petroleum activities which could realistically result in overlapping temporal and spatial extents. Other facilities located in proximity to the Operational Area were identified within Section 4.6.7, with the closest being the Pluto and Wheatstone platforms which are located 23 and 27 km, respectively, north-east of the Operational Area. In addition Woodside has other activities that may occur, within WA-49-L, concurrently with the Petroleum Activities Program.

Given the scale of potential impacts and the duration of the Petroleum Activities Program no cumulative risks or impacts will credibly occur.

[5] An environmental aspect is an element of the activity that can interact with the environment.

Table 6-1: Environmental impact and risk analysis and summary

Aspect	EP Section	Current Risk Rating				Acceptability of Risk
		Consequence	Potential Consequence level of impact[2]	Likelihood	Current Risk Rating	
Physical presence: Displacement to other users	**6.6.1**	F	Social and Cultural – no lasting effect (<1 month), localised impact not significant to areas/items of cultural significance.	-	-	Broadly Acceptable
Physical presence: Disturbance to benthic habitat from Anchor Hold Testing and ROV Operations	**6.6.2**	E	Environment – slight, short term local impact (< 1 year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	-	-	Broadly Acceptable
Routine acoustic emissions: Project Vessels and Positioning Equipment	**6.6.3**	F	Environment – no lasting effect (<1 month), localised impact not significant to environmental receptors (e.g. protected species).	-	-	Broadly Acceptable
Routine and non-routine discharges to the marine environment: Project vessels	**6.6.4**	F	Environment – no lasting effect (<1 month), localised impact not significant to environmental receptors (e.g. water quality).	-	-	Broadly Acceptable
Routine atmospheric emissions: Fuel combustion and incineration	**6.6.5**	F	Environment – no lasting effect (<1 month), localised impact not significant to environmental receptors (e.g. air quality).	-	-	Broadly Acceptable
Routine light emissions: External lighting on project vessels	**6.6.6**	F	Environment – no lasting effect (<1 month), localised impact not significant to environmental receptors (e.g. species).	-	-	Broadly Acceptable
Accidental hydrocarbon release: Vessel collision	**6.7.1**	D	Environment – minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystems), physical or biological attributes. Social and Cultural - Minor, short-term impact (1–2 years) to a community or highly valued areas/items of cultural significance	1	M	Broadly Acceptable
Unplanned discharges: Deck and subsea spills	**6.7.3**	F	Environment – no lasting effect (<1 month), localised impact not significant to environmental receptors (e.g. water quality).	2	L	Broadly Acceptable
Unplanned discharges: Loss of solid hazardous and non-hazardous wastes/equipment	**6.7.4**	F	Environment – no lasting effect (<1 month), localised impact not significant to environmental receptors (e.g. water quality).	2	L	Broadly Acceptable

Aspect	EP Section	Current Risk Rating				Acceptability of Risk
		Consequence	Potential Consequence level of impact[2]	Likelihood	Current Risk Rating	
Physical presence: Vessel collision with marine fauna	**6.7.5**	E	Environment – slight, short term local impact (<1 year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	1	L	Broadly Acceptable
Physical presence: Dropped object resulting in seabed disturbance	**6.7.6**	F	Environment – no lasting effect (<1 month), localised impact not significant to environmental receptors (e.g. benthic habitats).	2	L	Broadly Acceptable
Physical presence: Accidental introduction and establishment of invasive marine species	**6.7.7**	D	Environment – no credible risk identified.	0	L	Broadly Acceptable

6.3 Environmental Performance Outcomes, Standards and Measurement Criteria

Regulation 13(7) of the Environment Regulations requires that an EP includes environmental performance outcomes, environmental performance standards and measurement criteria that address legislative and other controls to manage the environmental impacts and risks of the activity to ALARP and Acceptable levels.

Environmental performance outcomes, standards and measurement criteria for the Petroleum Activities Program have been identified to allow the measurement of Woodside's environmental performance and the implementation of this EP to determine whether the environmental performance outcomes and standards have been met.

The environmental performance outcomes, standards and measurement criteria specified are consistent with legislative requirements and Woodside's standards and procedures. They have been developed based on the Codes and Standards, Good Industry Practices and Professional Judgement outlined in Section 3, as part of the acceptability and ALARP justification process.

The environmental performance outcomes, environmental performance standards and measurement criteria are presented throughout this section and in Appendix D (Oil Spill Preparedness and Response). A breach of these environmental performance outcomes or standards constitutes a 'Recordable Incident' under the Environment Regulations (refer to Section 7.8.4).

6.4 Presentation

The environmental impact and risk analysis and evaluation (ALARP and acceptability), environmental performance outcomes, standards and measurement criteria are presented in the following tabular form throughout this section. Italicised/green text in the following example denotes the purpose of each part of the table with reference to the relevant sections of the Environment Regulations and/or this EP.

Context <Description of the context for the impact/risk. Regulation 13(1, 13(2) and 13(3)>		
Description of the Activity – Regulation 13(1)	*Description of the Environment – Regulations 13(2)(3)*	*Consultation – Regulation 11A*

Impacts and Risks Evaluation Summary – ***Summary of ENVID outcomes***														
Source of impact/risk *Regulation 13(1)*	**Environmental Value Potentially Impacted** *Regulations 13(2)(3)*							**Evaluation** ***Section 2.6*** *and* ***Section 2.7***						
	Soil and Groundwater	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***
Summary of source of impact/risk														

Description of Source of Impact/Risk
Description of the identified impact/risk including sources or threats that may lead to the risk or identified event. Regulation 13(1).

Impact Assessment
Environmental Value/s Potentially Impacted
Discussion and assessment of the potential impacts to the identified environment value(s). Regulations 13(5)(6). *Potential impacts to environmental values have been assigned and discussed based on Woodside's Environmental Consequence Definitions for Use in Environmental Risk Assessments (**Table 2-3**).*

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[6]	***Benefit in Impact/Risk Reduction***[7]	***Proportionality***	***Control Adopted***
ALARP Tool Used – Section 2.7				
Summary of control considered to ensure the impacts and risks are continuously reduced to ALARP. *Regulation 13(5)(c).*	*Technical/logistical feasibility of the control.* *Cost/sacrifice required to implement the control (qualitative measure).*	*Quantum of impact/risk that could be averted (measured in terms of reduction of likelihood, consequence and current risk rating) if the cost/sacrifice is made and the control is adopted.*	*Proportionality of cost/sacrifice vs environmental benefit. If proportionate (benefits outweigh costs) the control will be adopted. If disproportionate (costs outweigh benefits) the control will not be adopted.*	*If control is adopted: Reference to Control # provided.*
ALARP Statement *Made on the basis of the environmental risk assessment outcomes, use of the relevant tools appropriate to the decision type (**Section 2.6.1** and **Figure 2-4**) and a proportionality assessment. Regulation 10A(b).*				

[6] Qualitative measure
[7] Measured in terms of reduction of likelihood (L), consequence (C) and current risk rating (CRR)

Demonstration of Acceptability
Acceptability Statement *Made on the basis of the application of the process described in **Section 2.7.2**, taking into account internal and external expectations, risk to environmental thresholds and use of environment decision principles. Regulation 10A(c).*

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO# **S:** ***Specific performance which addresses the legislative and other controls that manage the activity and against which performance by Woodside in protecting the environment will be measured.*** **M:** ***Performance against the outcome will be measured by measuring implementation of the controls via the measurement criteria.*** **A:** ***Achievability/feasibility of the outcome demonstrated via discussion of feasibility of controls in ALARP demonstration. Controls are directly linked to the outcome.*** **R:** ***The outcome will be relevant to the source of risk and the potentially impacted environmental value.*** **T:** ***The outcome will state the timeframe during which the outcome will apply or by which it will be achieved.***	**C#** *Identified control adopted to ensure the impacts and risks are continuously reduced to ALARP.* *Regulation 13(5)(c).*	**PS#** *Statement of the performance required of a control measure. Regulation 13(7)(a)*	**MC#** *Measurement criteria for determining whether the outcomes and standards have been met. Regulation 13(7)(c)*

6.5 Potential Environmental Risks Not Included Within the Scope of the Environmental Plan

The ENVID identified a number of environmental risks that were assessed as not being applicable (not credible) (refer Section 2.5) within or outside the Operational Area as a result of the Petroleum Activities Program. Therefore, they were determined to not form part of this EP. These are described in the following sections for information only.

6.5.1 Shallow/Near-shore Activities

The Petroleum Activities Program is located in water depths of about 166–511 m and at a distance of about 51 km from the nearest landfall (this being the Montebello Islands). Consequently, risks associated with shallow/near-shore activities such as anchoring and vessel grounding were assessed as not credible.

6.5.2 Accidental Hydrocarbon Release: Bunkering

Due to the short duration of the proposed activity, bunkering (refuelling of vessels while at sea) will not be required as part of the Petroleum Activities Program. Helicopters will not be used for this activity. Hydrocarbon release as a result of bunkering of vessels or helicopters is therefore not considered further in this EP.

6.6 Planned Activities (Routine and Non-routine)

6.6.1 Physical Presence: Displacement of Other Users

Context		
Project vessels – Section 3.5	Socio-economic environment – Section 4.6	Stakeholder consultation – Section 5

Impacts and Risks Evaluation Summary														
Source of Impact	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***
Displacement of other users – proximity of project vessels (AHV and support vessel) interfering with or displacing third party vessels (commercial fishing and commercial shipping)							X	A	F	-	-	GP PJ	Broadly Acceptable	EPO 1

Description of Source of Impact
The presence of the project vessels (AHV and one support vessel) is the only potential source of disturbance to other users in the Operational Area. Anchor hold testing is expected to take approximately 14 days to complete, therefore project vessel(s) may be present within the Operational Area for this duration. Activities will be 24 hours per day, seven days per week. While the anchor hold test is expected to commence in Q1 of 2020, the timing of the activity could occur at any time of the year (refer to Section 3.4). The presence of project vessels could present a minor navigational hazard to shipping and commercial fishing activities in the Operational Area. Tourism and recreation activities, including recreational fishing, are not expected in the Operational Area due to distance offshore and water depths (166-511 m).

Impact Assessment
Potential Impacts to Socio-Economic Environment
Displacement of Commercial Fishing Activities A number of Commonwealth and State managed fisheries overlap the Operational Area (**Section 4.6.3**). The Operational Area is situated within four Commonwealth and ten State managed fisheries. However, only two fisheries, the North West Slope Trawl Fishery (NWSTF) and Pilbara Line Fishery (PLF) are considered to be potentially active in the vicinity of the Operational Area. The north-west portion of the Operational Area overlaps with a very small portion of the NWSTF management area (about 1.9 km^2 of the 400,913 km^2 management area). The fishery is active along the 200 m isobath and the Operational Area is located at the most southern point of the area fished by the NWSTF in the 2017-18 season (Patterson et al., 2018, 2019). The Pilbara Line Fishery encompasses all of the ‘Pilbara waters’ (Fletcher & Santoro, 2014). There are no stated depth limits and the western extent of the fishery is the boundary of the Australian Fishing Zone. The Pilbara Line Fishery may operate within the Operational Area. The Operational Area is located in water depths ranging about 166–511 m, which is beyond the upper depth limit where typical Mackerel Managed Fishery effort occurs (up to about 100 m). The Operational Area is located within a closed (indefinite) area of the Pilbara Trawl and Pilbara Trap Fishery, and therefore effort from these fisheries is not expected within the Operational Area. Although overlapping with the boundaries of the Beche-de-mer, Pearl Oyster, Specimen Shell Fishery, Onslow Prawn Fishery or Marine Aquarium Managed Fisheries, the Operational Area is considered too far offshore to credibly impact these fisheries.

Given the low level of fishing activity expected in the Operational Area and the short duration of the activity (approximately 14 days), the presence of commercial fishing vessels in the Operational Area would likely be short term, potentially resulting in a minor interference (navigational hazard) and localised displacement/avoidance by commercial fishing vessels within the immediate vicinity of the project vessels. However, there was no direct response from commercial fisheries during the stakeholder consultation period, and as such the potential impact is considered to be minor and temporary.
Displacement to Commercial Shipping
The presence of the project vessels could potentially cause temporary disruption to commercial shipping. The Operational Area lies beyond designated shipping fairways in the region and is not subject to significant commercial vessel traffic (Section 4.6.6). AMSA did not raise concerns during the consultation period (Section 5.5). The potential impacts associated with this Petroleum Activities Program include displacement of vessels as they make slight course alteration to avoid the project vessels. Therefore, the potential impact is considered to be localised and temporary.
Summary of Potential Impacts to Environmental Values
Given the adopted controls, it is considered that physical presence of the project vessels will not result in a potential impact greater than localised, temporary displacement of shipping and commercial/recreational fishing interests (i.e. Socio - Economic Impact – F).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/ Sacrifice (CS)***[8]	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No controls identified.				
Good Practice				
Australian Hydrographic Service (AHS) will be notified of activities and movements no less than 4 working weeks prior to scheduled activity commencement date.	F: Yes. CS: Minimal cost. Standard practice.	Notification to AHS will enable them to generate navigation warnings (Maritime Safety Information Notifications (MSIN) and Notice to Mariners (NTM) (including AUSCOAST warnings where relevant)).	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes C 1.1
Notify DPIRD (WA) (formerly the WA Department of Fisheries) of activities within three months of activity commencement.	F: Yes. CS: Minimal cost. Standard practice.	Communicating the Petroleum Activities Program to other marine users ensures they are informed and aware, thereby reducing the likelihood of interfering with other marine users.	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes C 1.2
Notify AMSA Joint Rescue Coordination Centre (JRCC) of activities and movements 24-48 hours before operations commence.	F: Yes. CS: Minimal cost. Standard practice.	Communicating the Petroleum Activities Program to other marine users ensures they are informed and aware, thereby reducing the likelihood of interfering with other marine users.	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes C 1.3

[8] Qualitative measure

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/ Sacrifice (CS)[8]***	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
Professional Judgement – Eliminate				
Limit anchor hold testing to avoid peak shipping and commercial fishing activities.	F: No. Shipping occurs year-round and cannot be avoided. Simultaneous Operations (SIMOPS) with fishing seasons cannot be eliminated as exact timing for the activity is not confirmed. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the adopted controls appropriate to manage the impacts of the physical presence of the project vessels on other users, such as commercial fisheries and shipping. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that, given the adopted controls, physical presence of the project vessels on other users is unlikely to result in potential impact greater than localised impacts to commercial fishing and shipping. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice and meet requirements of Australian Marine Orders, and expectations of AMSA and AHS provided in consultation with stakeholders. The potential impacts and risks are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts and risks of physical presence of the Petroleum Activities Program to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 1 Marine users aware of the Petroleum Activities Program.	**C 1.1** Notify AHS of activities and movements no less than four working weeks prior to the scheduled activity commencement date.	**PS 1.1** Notification to AHS of activities and movements to allow generation of navigation warnings (Maritime Safety Information Notifications (MSIN) and NTM (including AUSCOAST warnings where relevant)).	**MC 1.1.1** Consultation records demonstrate that AHS has been notified before commencing an activity to allow generation of navigation warnings (MSIN and NTM (including AUSCOAST warnings where relevant)).

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	C 1.2 Notify DPIRD (WA) (formally the WA Department of Fisheries) of activities within three months of activity commencement.	**PS 1.2** Notification to DPIRD to inform other marine users of the activities to reduce activities interfering with other marine users for longer than necessary.	**MC 1.2.1** Consultation records demonstrate that DPIRD has been notified prior to activity commencement.
	C 1.3 Notify AMSA JRCC of activities and movements 24–48 hours before operations commence.	**PS 1.3** Notification to AMSA JRCC to prevent activities interfering with other marine users. AMSA's JRCC will require the AHV's details (including name, call sign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels and need to be advised when operations start and end.	**MC 1.3.1** Consultation records demonstrate that AMSA JRCC has been notified before commencing the activity within required timeframes.

6.6.2 Physical Presence: Disturbance to Benthic Habitat from Anchor Hold Testing and ROV Operations

Context	
Anchor hold testing – Section 3.7 ROV operations – Section 3.6	Biological environment – Section 4.5 Values and sensitivities – Section 4.7

Impacts and Risks Evaluation Summary

Source of Impact	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***
Disturbance to seabed from anchor hold testing					X			A	E	-	-	GP PJ	Broadly Acceptable	EPO 2
Disturbance to seabed from ROV operation					X			A	E	-	-			

Description of Source of Impact

Anchor Hold Testing

Anchor hold testing will result in seabed disturbance, including placement of anchors and chain/wire on the seabed and potential dragging during tensioning. Up to 10 locations will be tested using a seven tonne anchor and a twenty tonne anchor. A fifteen tonne anchor will also be carried as an optional component. Therefore, up to 30 anchor tests may be conducted within the Operational Area. The length of the anchor chain used for the tests will vary between 400 and 500 m.

The area of seabed affected by anchoring operations depends upon water depth, currents, size of the vessels and anchors, and length of anchor chain (NERA, 2018). Seabed disturbance from anchor hold testing will impact on receptors through direct contact between the seabed and the anchor and anchor chain, resulting in alteration of benthic habitat and localised and temporary increases in suspended sediments. Physical impacts to seabed properties and benthic populations may include smothering and scouring, burial and mortality of benthic fauna, increased sedimentation; and formation of mounds and trenches (Offshore Energy SEA, 2011; Evans et al., 2011).

Overall, the anchor hold testing activities will result in localised, small scale seabed disturbance relating to the benthic habitats described in Section 4.4.4 and Section 4.5.1.3. be tested.

ROV

An ROV may be used to inspect the seabed following anchor tensioning that may result in temporary seabed disturbance and suspension of sediment, causing increased turbidity as a result of working close to or occasionally on the seabed. ROV use close to or on the seabed will be limited to that required for effective and safe subsea activities. The footprint of a typical ROV is about 2.5 m × 1.7 m. This will cause localised and temporary impacts to water quality from increased turbidity and may cause localised and temporary impacts to benthic habitats. The ROV will not be used to relocate sediment (known as jetting).

Impact Assessment

Potential Impacts to Ecosystems/Habitats

Deepwater Benthic Habitats

Anchor hold testing is likely to result in localised physical modification to a small area of the seabed and disturbance to soft sediment.

An anchor must travel a certain horizontal distance before penetrating and embedding into the seabed. The drag length of the anchors may be up to a linear distance of 100 m from the drop location (NERA, 2018). The disturbance footprint

extends beyond this distance with the anchor chain. The maximum disturbance radius of each anchor drop will therefore not exceed the drag length, plus the additional length of the anchor chain that comes into contact with the seabed. Bathymetry surveys indicate that the south-west portion of the Operational Area, including the proposed Gemtree-A exploration well site, is located on the outer continental shelf and is predominantly flat and featureless. The north-east portion of the Operational Area overlaps with an area of seabed known as the 'upper slope' (water depth of 225–500 m) and forms part of the Continental Slope Demersal Fish Communities KEF. The Operational Area is expected to consist primarily of soft, fine unconsolidated sediments, which are typical of the broader NWMR. As such, physical impacts to the seabed are expected to be highly localised, non-significant disturbance to deepwater soft sediments. Due to the presence of soft sediments and lack of substantial areas of hard substrate, the seabed is likely to be inhabited by a low abundance of patchy distributions of filter feeders and other epifauna, including mobile epibenthos (e.g. sea cucumbers, ophiuroids, echinoderms, polychaetes and sea-pens, characteristic of the wider NWMR (Brewer et al., 2007). Impacts from anchor hold testing are expected to be confined to sediment burrowing- infauna and surface epifauna invertebrates, particularly filter feeders, inhabiting the seabed directly around the anchor test location (Hughes et al., 2010; Gates and Jones, 2012). Impacts to these broadly represented communities are expected to be highly localised with no significant impact to environment receptors. In areas of soft sediment with no sensitive benthic communities, any impact from anchoring is likely to be minimal and typically temporary (UK Marine SAC, 2001). The Continental Slope Demersal Fish Communities KEF (Section 4.7.3) overlaps the Operational Area. During anchoring activities, there is potential for sediment to be suspended into the water column, which can affect benthic communities through a decrease in water quality or light penetration near the seabed. Given the hydrodynamics in open ocean areas, the area of decreased water quality is expected to be localised and temporary, as sediments would settle out of the water column relatively quickly. Considering the short duration of the activity and localised disturbance footprint of an anchor and chain in relation to the mobile capacity of demersal fish and size of the KEF, potential impacts to the values of the KEF as a result of the anchor hold testing activity are not expected. Any impact to the benthic habitat of the KEF would be limited to slight and temporary disturbance and are not expected to impact the ecological values of the KEF as described in Section 4.7.3. Following recovery of the anchors, impacts from the disturbance are expected to be localised and short-term, with the underlying conditions present to support re-colonisation and recovery after the activity has been completed (Ingole et al. 2013). As such the anchor disturbance to the seabed is determined to be slight and temporary. ROV activities near the seafloor and small amounts of sediment relocation may result in slight and short-term impacts to deepwater biota, detailed above, as a result of elevated turbidity and the clogging of respiratory and feeding parts (turbidity) of filter feeding organisms. However, elevated turbidity would only be expected to be slight and short-term, and is therefore, not expected to have any significant impact to environment receptors.
Summary of Potential Impacts to Environmental Values
Given the adopted controls, seabed disturbance from the Petroleum Activities Program will result in localised, slight and short-term impacts to benthic habitat and communities (i.e. Environment Impact – E).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[9]***	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
Preliminary Mooring Analysis.	F: Yes. CS: Additional costs associated with upgraded MODU mooring design.	The Preliminary Mooring Analysis determines the number and spread of anchor hold test locations required, reducing the likelihood of seabed disturbance.	Benefits outweigh cost/sacrifice.	Yes C 2.1
USBL positioning technology used.	F: Yes. CS: Minimal cost. Standard practice.	Using positioning technology to accurately position infrastructure on the	Benefits outweigh cost/sacrifice.	Yes C 2.2

[9] Qualitative measure

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[9]***	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
		seabed will reduce seabed disturbance.		
Environmental monitoring of the seabed before and after the Petroleum Activities Program to assess any impacts to seabed.	F: Yes. CS: Significant. Monitoring of the seabed, particularly the deep waters of the Operational Area, would have significant additional costs to obtain and analyse data with the spatial resolution to accurately assess changes to the seabed habitat.	Environmental monitoring would not result in any additional seabed information above that already collected. Therefore, no additional reductions in likelihood or consequence would occur.	Control grossly disproportionate. Monitoring will not reduce the consequence or likelihood of any impacts to the seabed, and the cost associated with the level of monitoring required to accurately assess any impacts greatly outweighs the benefits gained. Although adopting this control could be used to verify EPOs, alternative controls identified also allow demonstration that the environmental outcome has been met based on the nature of the activity (i.e. predictable impacts) and relatively low sensitivity of the area.	No
Professional Judgement – Eliminate				
Do not complete anchor hold testing for the MODU for the proposed Gemtree-A exploration well.	F: No. Anchor hold testing is a requirement for a moored MODU in the described location and it is not technically feasible for the MODU to use DP in the water depth of the well location (about 201 m). Woodside has a demonstrated capacity to manage the environmental risks and impacts from mooring to a level that is ALARP and acceptable. CS: Not assessed, control not feasible.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Do not use ROV close to, or on, the seabed.	F: Yes. The use of ROVs (including work close to or occasionally landed on the seabed) is an important tool used to guide and manipulate equipment. ROV usage is already limited to only that required to conduct the work effectively and safely. Due to visibility and operational issues, ROV	Restricting the use of ROV would have limited environmental benefit, as impacts are temporary and localised.	Disproportionate. Based on the nature of the activity and impact (i.e. temporary) and relatively low sensitivity of the area, the environmental benefit is disproportionate to the technical	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[9]	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
	work on or close to the seabed is avoided unless necessary. CS: Minimal cost.		requirements, if required.	
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the adopted controls appropriate to manage the impacts of benthic habitat disturbance from anchor hold testing and ROV operations. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that, given the adopted controls, disturbance to benthic habitats is unlikely to result in a potential impact greater than a slight and short-term effect on habitat (but not affecting ecosystems function), including the values of the Continental Slope Demersal Fish Communities KEF. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice and meet the requirements of Woodside's relevant systems and procedures. The potential impacts and risks are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts and risks of seabed disturbance to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 2 No impact to benthic habitats greater than a consequence level of E inside the Operational Area during the Petroleum Activities Program.[10]	**C 2.1** Preliminary Mooring Analysis.	**PS 2.1** Seabed disturbance from anchor hold testing limited to that required to ensure adequate MODU station holding capacity.	**MC 2.1** Records demonstrate Preliminary Mooring Analysis completed. Anchor testing procedure developed and implemented during anchor deployment.
	C 2.2 USBL positioning technology used.	**PS 2.2** Anchors will be positioned in the planned location[11] where impacts have been assessed.	**MC 2.2.1** Records confirm USBL in place and functioning correctly.

[10] Defined as 'Slight, short term local impact (<1 year), on species, habitat but not affecting ecosystem function), physical or biological attributes' as in **Figure 2-6/Section 2.6.3**.

[11] Acceptable tolerance is considered to be ±150 m, given the homogenous and low sensitivity habitat.

6.6.3 Routine Acoustic Emissions: Generation of Noise from Project Vessels and Positioning Equipment

Context	
Project vessels – Section 3.5 Other support – Section 3.6	Biological environment – Section 4.5

Impacts and Risks Evaluation Summary

Source of Impact	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome[12]***
Generation of acoustic emissions from project vessels during normal operations						X		A	F	-	-	GP PJ	Broadly Acceptable	N/A
Generation of acoustic emissions from DP systems on project vessels						X		A	F	-	-			
Generation of noise from transponders						X		A	F	-	-			

Description of Source of Impact

The AHV, support vessel and positioning transponders will generate noise both in the air and underwater, due to the operation of thrusters, engines, propeller movement, etc. These noises will contribute to and can exceed ambient noise levels which range from around 90 dB re 1 µPa ((rms) rms) under very calm, low wind conditions, to 120 dB re 1 µPa (rms) under windy conditions (McCauley, 2005).

Project Vessel Noise

The main source of noise from a DP vessel (such as the AHV) relates to using DP thrusters. The AHV and support vessel, if required, will also use DP to maintain position. McCauley (1998) measured underwater broadband noise equivalent to about 182 dB re 1 µPa Sound Pressure Level (SPL) (rms) at 1 m from a support vessel holding station in the Timor Sea. Similar noise levels are expected to be generated by the support vessel used for this Petroleum Activities Program.

Note that all project vessels are required to comply with EPBC Regulation 2000 – Part 8 Interacting with Cetaceans to reduce the likelihood of collisions with cetaceans (refer to Section 6.7.5). Implementing this control may incidentally reduce the noise generated by vessels in proximity to cetaceans as vessels will be travelling slower; slower vessel speeds may reduce underwater noise from machinery noise (main engines) and propeller cavitation.

Generation of Underwater Noise from Positioning Equipment

USBL transponders may be installed on the anchors for metrology and positioning. Transponders typically emit pulses of medium frequency sound, generally within the range 21 to 31 Kilohertz (kHz). The estimated SPL would be 180 to 206 dB re 1 µPa at 1 m (Jiménez-Arranz et al., 2017).

Transmissions are not continuous but consist of short ‘chirps’ with a duration that ranges from 3 to 40 milliseconds. Transponders will not emit any sound when on standby. When required for general positioning they will emit one chirp every five seconds. When required for precise positioning they will emit one chirp every second.

Transponders will be attached to the anchors and will be submerged and emitting noise for only as long as the anchor hold test and will be retrieved alongside the anchor.

[12] There are no specific controls and EPOs identified for generation of noise from project vessels and positioning equipment. However, vessel power generation equipment will be maintained in accordance with preventative maintenance programs to optimise equipment efficiency and thus reduce excess noise generation e.g. vessel engines to be maintained as per manufacturer’s specification.

Impact Assessment
Potential Impacts to Protected Species
The Operational Area is located in waters about 166–511 m deep. The fauna associated with this area will be predominantly pelagic and demersal species of fish, with migratory species such as turtles, whale sharks and cetaceans transiting the area seasonally. Elevated underwater noise can affect marine fauna, including cetaceans, fish, turtles, sharks and rays in three main ways (Richardson et al., 1995; Simmonds et al., 2004): • by causing direct physical effects on hearing or other organs (injury) • by masking or interfering with other biologically important sounds (including vocal communication, echolocation, signals and sounds produced by predators or prey) • through disturbance leading to behavioural changes or displacement from important areas. The thresholds that could result in behavioural response for cetaceans is expected to be 120 dB re 1 µPa SPL (rms) for continuous noise sources, and 160 dB re 1 µPa SPL (rms) for impulsive noise sources. These thresholds are adopted by NOAA and are consistent with the levels presented by Southall et al. (2007). Potential for injury to hearing would be expected to occur at 230 dB re 1 µPa (pk) (Southall et al., 2007). Typical noise levels generated by the AHV or support vessel using DP will not exceed that level, so acoustic related injury to protected species is not anticipated. Listed Threatened and Migratory species under the EPBC Act that could be potentially impacted by underwater noise resulting in behavioural disturbance within the Operational Area primarily include cetaceans as well as sharks (including whale sharks), rays and turtles. The Operational Area overlaps the migration BIA for pygmy blue whales, which are seasonally present in the area from April to August (northbound) and October to late January (southbound). The Operational Area also overlaps with the whale shark foraging BIA (with peak numbers expected March to July) and an internesting BIA and a habitat critical to the survival of a species internesting buffer, for flatback turtles nesting at the Montebello Islands (with peak nesting in December and January). However, recent studies have demonstrated that the Operational Area does not represent suitable habitat for flatback turtles during internesting periods (Section 4.5.2.6). ***AHV and Support Vessel*** It is likely that there may be increased numbers of pygmy blue whales, humpback whales and whale sharks within the Operational Area during migratory periods. However, even with an increased likelihood of interaction the potential impacts are not considered to be significant to environmental receptors, given the noise levels associated with routine operations of project vessels. It is reasonable to expect that fauna may demonstrate avoidance or attraction behaviour to the noise generated by the Petroleum Activities Program. For example, when transiting through the area, pygmy blue whales may deviate slightly from their migration route, but continue on their migration pathway. Note that the Operational Area is surrounded by open water, with no restrictions (e.g. shallow waters, embayments) to an animal's ability to avoid the activities. Potential impacts from predicted noise levels from the project vessels are not considered to be ecologically significant at a population level. Other fauna associated with the Operational Area will be predominantly pelagic and demersal species of fish, with migratory species such as whale sharks, rays, marine turtles and other cetacean species migrating through or present in the Operational Area. Therefore, potential impacts from vessel noise are likely to be restricted to temporary avoidance behaviour to individuals transiting through the Operational Area, and are therefore considered localised with no lasting effect. ***Positioning Equipment Noise*** Transponders used for positioning of anchors have the potential to cause some temporary behavioural disturbance to marine fauna, but noise levels will be well below injury thresholds. Due to the short duration chirps, the temporary and intermittent use and the mid frequencies used by positioning equipment, the acoustic noise from the transponders is unlikely to have a substantive effect on the behavioural patterns of marine fauna. The Operational Area overlaps with the migration BIA for pygmy blue whales and the foraging BIA for whale sharks (as described above). Should the short period during which transponders are in use (over a period of up to 14 days) overlap with the seasonal timing of these BIAs, individual animals at most may deviate slightly from their migration route, but continue on their migration pathway. The Operational Area is surrounded by open water, with no restrictions (e.g. shallow waters, embayments) to an animal's ability to avoid the activities.
Summary of Potential Impacts to Environmental Values
It is considered that noise generated by the AHV, support vessel and positioning transponders will not result in a potential impact greater than localised impacts with no lasting effect, not significant to marine fauna (i.e. Environment Impact – F).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[13]***	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
The use of dedicated Marine Fauna Observers (MFOs) on project vessels for the duration of the Petroleum Activities Program to watch for whales and provide direction on and monitor compliance with Part 8 of the EPBC Regulations.	F: Yes. However, project vessel bridge crews already maintain a constant watch during operations. CS: Additional cost of MFOs.	Given that project vessel bridge crews already maintain a constant watch during operations, additional MFOs would not further reduce the likelihood or consequence of impact.	Disproportionate. The cost/sacrifice outweighs the benefit gained.	No
Professional Judgement – Eliminate				
Removal of optional support vessel at the Petroleum Activities Program location.	F: No. Activity support vessel may be required for safety reasons. CS: Introduces unacceptable safety risk.	Not considered – control not feasible.	Not considered – control not feasible.	No
Elimination of noise from the AHV, support vessel or survey positioning equipment.	F: No. The generation of noise from these sources cannot be eliminated due to operating requirements. Note that vessels operating on DP may be a safety critical- requirement. CS: Inability to conduct the Petroleum Activities Program. Loss of project.	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement – Substitute				
Management of vessel noise by varying the timing of the Petroleum Activities Program to avoid migration periods.	F: Not feasible. Variation of timing of specific activities is not feasible as activity is subject to schedule constraints and vessel availability. CS: Significant cost and schedule impacts if activities avoid specific timeframes and not proportionate given the assessment demonstrates no significant impacts to marine fauna.	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement – Engineered Solution				
No additional controls identified.				

[13] Qualitative measure

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[13]***	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
ALARP Statement On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the potential impacts from the AHV, support vessel and positioning transponder acoustic emissions to be ALARP. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement   The impact assessment has determined that the AHV, support vessel and positioning transponder noise disturbance is unlikely to result in a potential impact greater than localised impacts not significant to marine fauna, with no lasting effect. Further opportunities to reduce the impacts and risks have been investigated above. The potential impacts and risks are considered broadly acceptable. Therefore, Woodside considers standard operations appropriate to manage the impacts and risks of the AHV, support vessel and positioning transponder acoustic emissions to a level that is broadly acceptable.

6.6.4 Routine Discharges to the Marine Environment from Project Vessels

Context

Project vessels – Section 3.5	Physical environment – Section 4.4 Biological environment – Section 4.5

Impacts and Risks Evaluation Summary

Source of Impact	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***
Routine discharge of sewage, grey water and putrescible wastes to marine environment from project vessels			X					A	F	-	-	LCS PJ	Broadly Acceptable	EPO 3
Routine discharge of deck and bilge water to marine environment from project vessels			X					A	F	-	-			
Routine discharge of cooling water or brine to the marine environment from project vessels			X					A	F	-	-			

Description of Source of Impact

The project vessels (including AHV and support vessel) routinely generate/discharge the following:

- Small volumes of treated sewage and putrescible wastes to the marine environment – The impact assessment is based on a maximum approximate discharge of 3 m³ per vessel per day, using an average volume of 75 L/person/day and a maximum of 40 persons on board the AHV. The support vessel, if required, will have fewer people on board.
- Routine/periodic discharge of relatively small volumes of bilge water – Bilge tanks receive fluids from many parts of a vessel. Bilge water can contain water, oil, detergents, solvents, chemicals, particles and other liquids, solids or chemicals.
- Variable water discharge from vessel decks directly overboard or via deck drainage systems – Water sources could include rainfall events and/or deck activities such as cleaning/wash-down of equipment/decks.
- Cooling water from machinery engines or mud cooling units and brine water produced during the desalination process of reverse osmosis to produce potable water on board the project vessels.

Environmental risk relating to unplanned (accidental) disposal/discharge of waste is addressed in Section 6.7.4.

Impact Assessment

Potential Impacts to Water Quality and Marine Fauna

The main environmental impact associated with ocean disposal of sewage and other organic wastes (i.e. putrescible waste) is eutrophication. Eutrophication occurs when the addition of nutrients, such as nitrates and phosphates, causes adverse changes to the ecosystem, such as oxygen depletion and phytoplankton blooms. Other contaminants of concern occurring in these discharges may include ammonia, *E. coli*, faecal coliforms, volatile and semi-volatile organic compounds, phenol, hydrogen sulphide, metals, surfactants and phthalates.

Mixing and dispersion is facilitated in deep offshore waters, consistent with the location of the Operational Area, through regional wind and large scale current patterns resulting in the rapid mixing of surface and near surface waters where sewage discharges may occur. Studies investigating the effects of nutrient enrichment from offshore sewage discharges indicate that the influence of nutrients in open marine areas is much less significant than that experienced in enclosed areas (McIntyre & Johnston, 1975).

Furthermore, open marine waters do not typically support areas of increased ecological sensitivity, due to the lack of nutrients in the upper water column and lack of light penetration at depth. Therefore presence of other receptors such as fish, reptiles, birds and cetaceans in significant numbers, and in close proximity to the Operational Area, is unlikely. Research also suggests that zooplankton composition and distribution are not affected in areas associated with sewage dumping grounds (McIntyre & Johnston, 1975). Plankton communities are expected to rapidly recover from any such, localised impact, as they are known to have naturally high levels of mortality and a rapid replacement rate. Additional discharges outlined, which may include other non-organic contaminants (e.g. bilge water, deck drainage), will be rapidly diluted through the same mechanisms as above and are expected to be in very small quantities and concentrations as to not pose any significant risk to any relevant receptors. As such, no significant impacts from the planned (routine and non-routine) discharges that are listed above are anticipated because of the minor quantities involved, the expected localised mixing zone and high level of dilution into the open water marine environment of the Operational Area. The Operational Area is located more than 12 nm from land, which exceeds the exclusion zones required by Marine Order 96 (Marine pollution prevention – sewage) 2018 and Marine Order 95 (Marine pollution prevention – garbage) 2018. Due to the short duration (approximately 14 days) of the Petroleum Activities Program and intermittent nature of these routine and non-routine discharges, impacts to water quality within the Operational Area are expected to be localised with no lasting effect. It is possible that protected marine fauna transiting the area may come into contact with these discharges (e.g. pygmy blue whales and whale sharks) as they traverse the Operational Area (Section 4.5.2). However, given the localised extent of impacts from vessel discharges within the Operational Area, significant impacts to marine fauna are not expected. Given the short duration and exposed location of the Operational Area, which will lead to the rapid dispersion of the low volumes of the wastes described above, the potential impacts are expected to have no lasting effect.
Summary of Potential Impacts to Environmental Values
Given the adopted controls, it is considered that routine or non-routine discharges described will not result in a potential impact greater than localised contamination not significant to environmental receptors, with no lasting effect (i.e. Environment Impact – F).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[14]	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 95 – marine pollution prevention—garbage (as appropriate to vessel class) which requires putrescible waste and food scraps to pass through a macerator so it is capable of passing through a screen with no opening wider than 25 mm.	F: Yes. CS: Minimal cost. Standard practice.	No reduction in likelihood or consequence would result.	Controls based on legislative requirements – must be adopted.	Yes C 3.1

[14] Qualitative measure

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[14]	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
Marine Order 96 – marine pollution prevention—sewage (as appropriate to vessel class) which includes the following requirements: • a valid International Sewage Pollution Prevention Certificate, as required by vessel class • a sewage treatment plant approved by AMSA or an issuing body • a sewage comminuting and disinfecting system • a sewage holding tank sized appropriately to contain all generated waste (black and grey water) • discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nm from the nearest land • discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at a distance of more than 3 nm from the nearest land • discharge of sewage will occur at a moderate rate while support vessel is proceeding (> 4 knots), to avoid discharges in environmentally sensitive areas.	F: Yes. CS: Minimal cost. Standard practice.	No reduction in likelihood or consequence would result.	Controls based on legislative requirements – must be adopted.	Yes C 3.2
Where there is potential for loss of primary containment of oil and chemicals on the project vessels, deck drainage must be collected via a closed drainage system.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of contaminated deck drainage water being discharged to the marine environment. No change in consequence would occur.	Benefits outweigh cost/sacrifice.	Yes C 3.3
Marine Order 91 – marine pollution prevention—oil (as relevant to vessel class) requirements, which includes mandatory measures for processing oily water prior to discharge: • Machinery space bilge/oily water shall have IMO-approved oil filtering equipment (oil/water separator) with an on-line monitoring device to measure Oil in Water (OIW) content to be less than 15 Parts per Million (ppm) prior to discharge.	F: Yes. CS: Minimal cost. Standard practice.	No reduction in likelihood or consequence would result.	Controls based on legislative requirements – must be adopted.	Yes C 3.4

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[14]	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
• IMO-approved oil filtering equipment shall also have an alarm and an automatic stopping device or be capable of recirculating if OIW concentration exceeds 15 ppm. • A deck drainage system shall be capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination. • There shall be a waste oil storage tank available, to restrict oil discharges. • If machinery space bilge discharges cannot meet the oil content standard of <15 ppm without dilution or be treated by an IMO-approved oil/water separator, they will be contained on-board and disposed onshore. • Valid International Oil Pollution Prevention Certificate.				
Good Practice				
No additional controls identified.				
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
Storage, transport and treatment/disposal onshore of sewage, greywater, putrescible and bilge wastes.	F: Not feasible. Would present additional safety and hygiene hazards resulting from the storage, loading and transport of the waste material. Distance of activity offshore also makes implementing this control not feasible. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the adopted controls appropriate to manage the impacts of routine discharges to the marine environment from project vessels. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that, given the adopted controls, routine discharges to the marine environment from project vessels are unlikely to result in a potential impact greater than localised impacts not significant to environmental receptors and no lasting effect. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice and meet legislative requirements under Marine Orders 91, 95 and 96. The potential impacts and risks are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts and risks of these discharges to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 3 No impact to water quality greater than a consequence level of F from discharge of sewage, greywater, putrescible wastes, bilge and deck drainage to the marine environment during the Petroleum Activities Program.	**C 3.1** Marine Order 95 – marine pollution prevention—garbage (as appropriate to vessel class) which requires putrescible waste and food scraps to pass through a macerator so it is capable of passing through a screen with no opening wider than 25 mm.	**PS 3.1** Project vessels compliant with Marine Order 95.	**MC 3.1.1** Records demonstrate project vessels are compliant with Marine Order 95 (as appropriate to vessel class).
	C 3.2 Marine Order 96 – marine pollution prevention—sewage (as appropriate to vessel class) which includes the following requirements: • a valid International Sewage Pollution Prevention Certificate, as required by vessel class • a sewage treatment plant approved by AMSA or an issuing body • a sewage comminuting and disinfecting system • a sewage holding tank sized appropriately to contain all generated waste (black and grey water) • discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nm from the nearest land • discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at a distance of more than 3 nm from the nearest land • discharge of sewage will occur at a moderate rate while support vessel is proceeding (>4 knots), to avoid discharges	**PS 3.2** Project vessels compliant with Marine Order 96 (as appropriate to vessel class).	**MC 3.2.1** Records demonstrate project vessels are compliant with Marine Order 96 (as appropriate to vessel class).

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	in environmentally sensitive areas.		
	C 3.3 Where there is potential for loss of primary containment of oil and chemicals on the project vessels, deck drainage must be collected via a closed drainage system, e.g. drill floor.	**PS 3.3** Contaminated drainage contained, treated and/or separated prior to discharge.	**MC 3.3.1** Records demonstrate AHV has a functioning deck drainage water management system.
	C 3.4 Marine Order 91 – marine pollution prevention—oil (as relevant to vessel class) requirements, which includes mandatory measures for processing oily water prior to discharge: • Machinery space bilge/oily water shall have IMO-approved oil filtering equipment (oil/water separator) with an on-line monitoring device to measure OIW content to be less than 15 ppm prior to discharge. • IMO-approved oil filtering equipment shall also have an alarm and an automatic stopping device or be capable of recirculating if OIW concentration exceeds 15 ppm. • A deck drainage system shall be capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination. • There shall be a waste oil storage tank available, to restrict oil discharges. • If machinery space bilge discharges cannot meet the oil content standard of <15 ppm without dilution or be treated by an IMO-approved oil/water separator, they will be contained on-board and disposed onshore. • Valid International Oil Pollution Prevention Certificate.	**PS 3.4** Discharge of machinery space bilge/oily water will meet oil content standard of <15 ppm without dilution.	**MC 3.4.1** Records demonstrate discharge specification met for project vessels.

6.6.5 Routine Atmospheric Emissions: Fuel Combustion and Incineration

Context	
Project vessels – Section 3.5	Physical environment – Section 4.4

Impacts and Risks Evaluation Summary														
Source of Impact	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***
Internal combustion engines and incinerators on project vessels				X				A	F	-	-	LCS PJ	Broadly Acceptable	EPO 4

Description of Source of Impact
Atmospheric emissions will be generated by the project vessels from internal combustion engines (including all equipment and generators) and incineration activities (including on-board incinerators) during the Petroleum Activities Program. Emissions will include sulphur dioxide (SO_2), nitrogen oxide (NO_x), ozone-depleting substances, carbon dioxide (CO_2), particulates and volatile organic compounds (VOCs).
Impact Assessment
Potential Impacts to Air Quality Fuel combustion and incineration has the potential to result in a localised, temporary reduction in air quality. Potential impacts include a localised reduction in air quality, generation of dark smoke and contribution to greenhouse gas emissions. Given the short duration and exposed location of the Operational Area, which will lead to the rapid dispersion of the low volumes of atmospheric emissions, the potential impacts are expected to have no lasting effect, with no cumulative impacts when considered in the context of existing commercial shipping operations in the region.
Summary of Potential Impacts to Environmental Values
Given the adopted controls, it is considered that fuel combustion emissions will not result in a potential impact greater than a temporary decrease in local air quality and/or water quality standards, with no lasting effect and no significant impact to environmental receptors (i.e. Environment Impact – F).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/ Sacrifice (CS)***[15]	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 97 (marine pollution prevention—air pollution).	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed may slightly reduce the likelihood of air pollution.	Control based on legislative requirements – must be adopted.	Yes C 4.1

[15] Qualitative measure

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/ Sacrifice (CS)[15]***	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
Good Practice				
No additional controls identified.				
Professional Judgement – Eliminate				
Do not combust fuel.	F: No. There are no vessels that do not use internal combustion engines. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the adopted controls appropriate to manage the impacts of fuel combustion and incineration. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that, given the adopted controls, fuel combustion and incineration are unlikely to result in a potential impact greater than a temporary decrease in local air quality and/or water quality standards, with no lasting effect. Further opportunities to reduce the impacts and risks have been investigated above. The controls adopted meet the legislative requirements within Marine Order 97. The potential impacts and risks are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts and risks of the described emissions to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 4 Fuel combustion and incineration during the Petroleum Activities Program is restricted to what is necessary to perform the activity.	**C 4.1** Marine Order 97 (marine pollution prevention—air pollution) which details requirements for: • International Air Pollution Prevention Certificate, required by vessel class • use of low sulphur fuel when available • Ship Energy Efficiency Management Plan, where required by vessel class • onboard incinerator to comply with Marine Order 97.	**PS 4.1** Project vessels compliant with Marine Order 97 to restrict emissions to those necessary to perform the activity. Vessel marine assurance process conducted prior to contracting vessels, to ensure suitability and compliance with vessel combustion certification/ Marine Order requirements.	**MC 4.1.1** Marine Assurance inspection records demonstrate compliance with Marine Order 97.

6.6.6 Routine Light Emissions: External Lighting on Project Vessels

Context	
Project vessels – Section 3.5	Physical environment – Section 4.4 Biological environment – Section 4.5

Impacts and Risks Evaluation Summary

Source of Impact	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***[16]
External light emissions on-board the project vessels						X		A	F	-	-	PJ	Broadly Acceptable	N/A

Description of Source of Impact

Project vessels will have external lighting to facilitate navigation and safe operations at night throughout the Petroleum Activities Program. External light emissions from the project vessels are typically managed to maintain good night vision for crew members.

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

The highest point on the AHV which is routinely lit are the bridge lights, which are about 21 m above sea level. The distance to the horizon at which the AHV will be directly visible can be estimated using the formula of:

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

Where 'horizon distance' is the distance to the horizon at sea level in kilometres and 'height' is the height above sea level of the light source in metres. Using this formula, the approximate distance at which the bridge lights will be visible at sea level are about 16 km from the AHV.

The vessel's search lights, which are only used on occasion, are located about 24 m above sea level and would be visible from about17 km from the AHV when in use.

Impact Assessment

Potential Impacts to Protected Species

Light emissions can affect fauna in two main ways:

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

Fauna within the Operational Area are predominantly pelagic fish and zooplankton, with a low abundance of transient species such as marine turtles, whale sharks, whales and migratory sea birds transiting through the Operational Area. A flatback turtle internesting BIA and internesting buffer identified as habitat critical to the survival of the species, extending from nesting at the Montebello Islands overlaps with part of the Operational Area. In addition there is overlap

[16] There are no specific controls and EPOs identified for external lighting on project vessels. However, minimum lighting aboard the project vessels will be maintained to facilitate safe operations and navigation.

with BIAs for whale shark foraging, pygmy blue whale migration and wedge-tailed shearwater foraging. Pygmy blue whales and whale sharks are not expected to be impacted by above-surface light emissions beyond opportunistic feeding that may occur as a result of prey aggregations around the light source. Given the fauna expected to occur within the Operational Area, impacts from light emissions are considered to be highly unlikely. ***Marine Turtles – Adults*** Artificial lighting may affect the location that turtles emerge to the beach, the success of nest construction, whether nesting is abandoned, and even the seaward return of adults (Salmon et al., 1995a, 1995b; Salmon and Witherington, 1995). However, such lighting is typically from residential and industrial development overlapping the coastline, rather than offshore from nesting beaches. While the Operational Area overlaps with the north-west extent of a BIA for flatback turtle internesting and the habitat critical to the survival of flatback turtles internesting buffer (described in Section 4.5.2), the nearest landfall for these occurs at North West Island of the Montebello Islands, about 51 km south-east of the Operational Area. Impacts to nesting turtles are therefore not expected. Given the water depth of the Operational Area (at least ~166 m), turtles are highly unlikely to be foraging. However, it is acknowledged that marine turtles may transit the Operational Area in very low densities. ***Migratory Birds*** The Operational Area may be occasionally visited by migratory and oceanic birds but does not contain any emergent land that could be used as roosting or nesting habitat and contains no known critical habitats (including feeding for any species. A BIA for wedge-tailed shearwater foraging overlaps with the Operational Area, with the breeding period occurring from August to April (Section 4.5.2). Seabird surveys over the Northwest Shelf Province have noted that seabird distributions in tropical waters were generally patchy, except near islands (Dunlop et al., 1988). Given the Operational Area lies offshore with the closest island 51 km away, seabirds are likely to only transit over the Operational Area when travelling between emergent land and important habitats. Migratory shorebirds may be present in or fly through the region between July and December and again between March and April as they complete migrations between Australia and offshore locations (DSEWPaC, 2012d). The risk associated with collision from seabirds attracted to the light is considered to be low, given the low numbers expected to transit the area and that there is no critical habitat for these species within the Operational Area, as well as the slow moving speeds associated with the project vessels. ***Fish*** Lighting from the presence of a vessel may result in the localised aggregation of fish below the vessel. These aggregations of fish are considered localised and temporary and any long term changes to fish species composition or abundance is considered highly unlikely. This localised increase in fish extends to those comprising the whale shark's diet. However, given that a large proportion of the diet comprises krill and other planktonic larvae, it is unlikely that a light source will lead to a significant increase in whale shark abundance in the vicinity of the project vessels.
Summary of Potential Impacts to Environmental Values
Light emissions from the project vessels will not result in an impact greater than localised and temporary disturbance to fauna in the vicinity of the Operational Area, with no lasting effect (i.e. Environment Impact – F).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[17]	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
No additional controls identified.				
Professional Judgement – Eliminate				
Substitute external lighting with 'turtle friendly' light sources (reduced emissions in turtle visible spectrum).	F: Yes. Replacing external lighting with turtle friendly lighting is technically feasible, although is not considered to be practicable. CS: Significant cost sacrifice. The retrofitting of all external lighting on the project vessels, etc., would result in considerable cost and time expenditure. Considerable	Given the potential impacts to turtles during this activity is insignificant, implementing this control would not result in a reduction in consequence.	Grossly disproportionate. Implementation of the control requires considerable cost sacrifice for minimal environmental benefit.	No

[17] Qualitative measure

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[17]***	***Benefit in Impact Reduction***	***Proportionality***	***Control Adopted***
	logistical effort to source sufficient inventory of the range of light types onboard the project vessels.		The cost/sacrifice outweighs the benefit gained.	
Exclude peak turtle internesting periods (December to January) from the timing of the Petroleum Activities Program.	F: No. The Operational Area has a minor overlap with the flatback turtle internesting BIA and habitat critical to the survival of flatback turtles internesting buffer, in an area not known to provide foraging habitat. Given the low potential for inter-nesting turtles to be present within the Operational Area and the short duration of the survey the risk of potential impacts from vessel light emissions on adult turtles is considered to be very low. CS: Significant cost and schedule impacts due to delays in securing vessels for specific timeframes.	Not considered – control not feasible.	Not considered, control not feasible.	No
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the potential impacts from routine light emissions from the project vessels to be ALARP in its current risk state. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that, in its current state, routine light emissions from the project vessels are unlikely to result in a potential impact greater than localised behavioural disturbance to fauna within the Operational Area, with no lasting effect. Further opportunities to reduce the impacts and risks have been investigated above. The potential impacts and risks are consistent with good oil-field practice/industry best practice and are considered to be broadly acceptable in its current state. Therefore, Woodside considers standard operations appropriate to manage the impacts and risks of routine light emissions to a level that is broadly acceptable.

6.7 Unplanned Activities (Accidents, Incidents, Emergency Situations)

6.7.1 Quantitative Spill Risk Assessment Methodology

Quantitative hydrocarbon spill modelling was performed by RPS, on behalf of Woodside, using a three-dimensional hydrocarbon spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program). The model is designed to simulate the transport, spreading and weathering of specific hydrocarbon types under different environmental conditions (both meteorological and oceanographic). Near-field subsurface discharge modelling was performed using OILMAP, which predicts the droplet sizes that are generated by the turbulence of the discharge as well as the centreline velocity, buoyancy, width and trapping depth (if any) of the rising gas and oil plumes. The OILMAP output parameters were used as input into SIMAP.

The algorithms in the SIMAP model are based on the best available scientific knowledge, and are updated when necessary in response to significant advances in knowledge. Recent improvements have been implemented to the entrainment algorithm, which have been adjusted to implement the findings of published data based on field research performed during the Macondo spill event in the Gulf of Mexico (Spaulding et al., 2017; Li et al., 2017; French-McCay et al., 2018).

Stochastic modelling was conducted, which compiled data from 200 hypothetical spills under different environmental conditions to determine the widest extent of possible oil dispersion. The environmental conditions for each of the hypothetical spills were selected randomly from an historic time-series of wind and current data representative of the study area. Results of the replicate simulations were then statistically analysed and mapped to define contours of percentage probability of contact at identified thresholds around the hydrocarbon release point. The simulations that show something unusual or unexpected make an important contribution to the overall outcomes and fate of the hydrocarbon.

The model simulates surface releases and uses the unique physical and chemical properties of a representative hydrocarbon type to calculate rates of evaporation and viscosity change, including the tendency to form oil-in-water emulsions. Moreover, the unique transport and dispersion of surface slicks and in-water components (entrained and dissolved) are modelled separately. Thus, the model can be used to understand the wider potential consequences of a spill, including direct contact of hydrocarbons due to surface slicks (floating hydrocarbon) and exposure of organisms to entrained and dissolved aromatic hydrocarbons in the water column. The model also calculates the accumulation of hydrocarbon mass that arrives on each section of shoreline over time, taking into account any mass that is lost to evaporation and/or subsequent removal by current and wind forces.

All hydrocarbon spill modelling assessments performed by RPS undergo initial sensitivity modelling to determine appropriate time to add to the simulation after the cessation of the spill. The amount of time following the spill is based on the time required for the modelled concentrations to practically drop below threshold concentrations anywhere in the model domain in the test cases.

6.7.1.1 Environment that May Be Affected and Hydrocarbon Contact Thresholds

The outputs of the quantitative hydrocarbon spill modelling are used to assess the environmental risk, if a credible hydrocarbon spill scenario occurred, by delineating which areas of the marine environment could be exposed to hydrocarbon levels exceeding hydrocarbon threshold concentrations. The summary of all the locations where hydrocarbon thresholds could be exceeded by any of the simulations modelled is defined as the EMBA, which is driven by the worst-case credible hydrocarbon spill scenario. In this instance the worst-case credible scenario is integrity vessel collision resulting in a release of marine diesel oil (MDO).

As the weathering of different fates of hydrocarbons (surface, entrained and dissolved) differs due to the influence of the metocean mechanism of transportation, the EMBA combines the potential spatial extent of the different fates. The EMBA also includes areas that are predicted to experience shore-line contact with hydrocarbons above threshold concentrations.

The EMBA covers a larger area than the area that is likely to be affected during any single spill event, as the model was run for a variety of weather and metocean conditions (200 simulations in total). The EMBA therefore represents the total extent of all the locations where hydrocarbon thresholds could be exceeded from all modelling runs.

Surface and accumulated shoreline hydrocarbon concentrations are expressed as grams per square metre (g/m²), with entrained and dissolved aromatic hydrocarbon concentrations expressed as parts per billion (ppb). A conservative approach adopting accepted contact thresholds that are documented to impact the marine environment is used to define the EMBA. These hydrocarbon thresholds are presented in Table 6-2 and described in the following subsections.

Woodside recognises that hydrocarbons may be present beyond the ecological impact EMBA at low concentrations that may be visible, but are not expected to cause ecological impacts. The threshold for visible surface oil (1 g/m^2) has therefore been used to define an additional boundary within which socio-cultural impacts to the visual amenity of the marine environment may occur. This area is referred to as the socio-cultural EMBA. Any ecological impacts from dissolved and entrained hydrocarbons above prescribed thresholds, as in Table 6-2, may also result in socio-cultural impacts. Potential impacts to socio-cultural values assessed within these EMBAs include the following:

- protected areas;
- National and Commonwealth Heritage Listed places;
- tourism and recreation;
- fisheries.

Table 6-2: Summary of environmental impact thresholds applied to the quantitative hydrocarbon spill risk modelling results

EMBA	Surface hydrocarbon (g/m²)	Entrained hydrocarbon (ppb)	Dissolved aromatic hydrocarbon (ppb)	Accumulated hydrocarbon (g/m²)
Diesel	1 and 10	500	500	100

6.7.1.2 Surface Hydrocarbon Threshold Concentrations

The spill modelling outputs defined the EMBA for surface hydrocarbons resulting from a spill (contact on surface waters) using a threshold of ≥10 g/m². This is equivalent to dull metallic colours based on the relationship between film thickness and appearance (Bonn Agreement, 2015) (Table 6-3). This threshold concentration is geared towards informing potential oiling impacts for wildlife groups and habitats that may break through the surface slick from the water or the air (for example: emergent reefs, vegetation in the littoral zone and air-breathing marine reptiles, cetaceans, seabirds and migratory shorebirds).

Thresholds for registering biological impacts resulting from contact of surface slicks have been estimated by different researchers at about 10–25 g/m² (French et al., 1999; Koops et al., 2004; NOAA, 1996). Potential impacts of surface slick concentrations in this range for floating hydrocarbons may include harm to seabirds through ingestion from preening contaminated feathers, or the loss of the thermal protection of their feathers. The 10 g/m² threshold is the reported level of oiling to instigate impacts to seabirds and is also applied to other wildlife, though it is recognised that ‘unfurred’ animals, where hydrocarbon adherence is less, may be less vulnerable. ‘Oiling’ at this threshold is taken to be of a magnitude that can cause a response to the most vulnerable wildlife such as seabirds. Due to weathering processes, surface hydrocarbons will have a lower toxicity due to change in their composition over time. Potential impacts to shoreline sensitive receptors may be markedly reduced in instances where there is extended duration until contact. The 10 g/m² threshold is considered appropriate for diesel delineating potential chronic and acute effects to ecosystems.

A lower concentration of 1 g/m^2, which represents a rainbow sheen on the surface (Table 6-3), has also been used to define a wider area within which socio-cultural impacts to the visual amenity of the marine environment may occur.

Table 6-3: The Bonn Agreement Oil Appearance Code (BAOAC)

Appearance (following BAOAC visibility descriptors)	Mass per area (g/m²)	Thickness in micrometers (µm)	Volume per area (L/km^2)
Discontinuous true oil colours	50 to 200	50 to 200	50,000 to 200,000
Dull metallic colours	5 to 50	5 to 50	5000 to 50,000
Rainbow sheen	0.30 to 5.00	0.30 to 5.00	300 to 5000
Silver sheen	0.04 to 0.30	0.04 to 0.30	40 to 300

6.7.1.3 Accumulated Hydrocarbon Threshold Concentrations

Owens and Sergy (1994) define accumulated hydrocarbon <100 g/m² to have an appearance of a stain on shorelines. French-McCay (2009) defines accumulated hydrocarbons ≥100 g/m² to be the threshold that could impact the survival and reproductive capacity of benthic epifaunal invertebrates living in intertidal habitat. A threshold of ≥100 g/m² has therefore been adopted to define the EMBA for a diesel spill. Further, any ecological impacts at the accumulated thresholds concentration EMBA may also result in socio-cultural impacts.

6.7.1.4 Dissolved Aromatic Hydrocarbon Threshold Concentrations

The threshold concentration value for dissolved hydrocarbons has been established with reference to results from Woodside-commissioned ecotoxicity tests on Marine Diesel Oil (Ecotox Services Australia (ESA 2013)).

The ecotoxicity tests were undertaken on a broad range of taxa of ecological relevance for which accepted standard test protocols are well established. These ecotoxicology tests are focused on the early life stages of test organisms, when organisms are typically at their most sensitive. The eight ecotoxicology tests were conducted on seven mainly tropical-subtropical species representatives from six major taxonomic groups. The seven species were tested for chronic (function of life) effects of immobilisation, early life stage development/growth and acute toxicity (i.e. mortality).

The laboratory-based ecotoxicity tests used a range of water accommodated fraction (WAF) concentrations to expose the different test organisms. For each ecotoxicity test, samples of the WAF were analysed to determine the TPH concentration of the solution. The ecotoxicity testing focusses on the total petroleum hydrocarbons (TPH) concentration of the WAF of the hydrocarbon and includes the carbon chains C_6 to C_{36}. TPH concentration is representative of the sum of the hydrocarbons in each test solution for C_6–C_{36}. Typically, C_4 to C_{10} compounds are volatile (boiling point (BP) < 180 °C), C_{11} to C_{15} compounds are semi-volatile (BP 180–265 °C), C_{16} to C_20 compounds have low volatility (265–380 °C) and C_{21} compounds and above are residual (BP > 380 °C).

Table 6-4 presents the results of the 'no-observed-effect concentrations' (NOEC) for the marine diesel WAFs. The reported NOECs for organisms tested ranged from 520 ppb to 3500 ppb. For seven of the nine tests, no statistically significant effect on the test organisms was observed even at the highest WAF concentration used in the testing (denoted with the symbol # in Table 6-4).

Based on these ecotoxicology tests, a conservative threshold of 500 ppb has been adopted. This 500 ppb threshold is below the lowest NOEC for the most sensitive organism tested. These thresholds are calculated based on exposure of organisms to dissolved aromatic hydrocarbons for periods of 1 to 96 hours and are, therefore, conservative when used for instantaneous contact.

Table 6-4: Summary of Total Petroleum Hydrocarbons (TPH) NOECs for key life histories of different biota based on Toxicity tests for WAF of marine diesel (ESA 2013)

Biota and life stage	Exposure duration	NOEC TPH (ppb)
Sea urchin fertilisation	1 hours	3500 #
Sea urchin larval development	72 hours	3500 #
Milky oyster larval development	48 hours	3500 #
Micro-algal growth test	72 hours	520
Macro-algal (kelp) germination test	72 hours	2530 #
Rock oyster larval spat	48 hours	3500 #
Amphipod juvenile survival	96 hours	520
Copepod juvenile survival	48 hours	2530 #
Larval fish imbalance test	96 hours	2530 #

Lowest-observable-effect concentration (LOEC) was not reached during test.

6.7.1.5 Entrained Hydrocarbon Threshold Concentrations

The spill modelling outputs are used to define the EMBA by defining the spatial variability of entrained hydrocarbons above a set concentration threshold contacting sensitive receptors (expressed in ppb).

Entrained hydrocarbons present a number of possible mechanisms for toxic exposure to marine organisms. The entrained hydrocarbon droplets may contain soluble compounds, hence have the potential for generating elevated concentrations of dissolved aromatic hydrocarbons (e.g. if mixed by breaking waves against a shoreline). Physical and chemical effects of the entrained hydrocarbon droplets have also been demonstrated through direct contact with organisms; for example, through physical coating of gills and body surfaces and accidental ingestion (National Research Council, 2005).

The threshold concentration of entrained hydrocarbons that could result in a biological impact cannot be determined directly using available ecotoxicity data for WAF of hydrocarbons (Table 6-4). However, entrained hydrocarbons are less biologically available to organisms through absorption into their tissues than dissolved aromatic hydrocarbons. Therefore adoption of a threshold based on WAF toxicity data will be a conservative approach. The selected threshold of 500 ppb is below the NOEC for the seven sensitive organisms tested in relation to dissolved hydrocarbons.

The modelling of entrained hydrocarbons specifically represents the total volume of diesel predicted to be entrained under metocean conditions. As discussed above, the dissolved threshold is based on the exposure of organisms for periods of 1 to 96 hours and therefore is highly conservative when used for instantaneous contact.

6.7.1.6 Scientific Monitoring

A planning area for scientific monitoring is also described in Section 5.7 of the Oil Spill Preparedness and Response Mitigation Assessment (Appendix D). This planning area has been set with reference to the low exposure entrained value of 10 ppb detailed in NOPSEMA Bulletin #1 Oil Spill Modelling (2019).

A scientific monitoring program would be activated following a Level 2 or 3 unplanned hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors. This would consider receptors at risk (ecological and socio-economic) for the entire predicted EMBA and in particular, any identified Pre-emptive Baseline Areas (PBAs) for the worst-case credible spill scenario(s) or other identified unplanned hydrocarbon releases associated with the operational activities.

6.7.2 Accidental Hydrocarbon Release: Vessel Collision

Context		
Project vessels – Section 3.5	Physical environment – Section 4.4 Biological environment – Section 4.5 Socio-economic environment – Section 4.6 Values and sensitivities – Section 4.7	Stakeholder consultation – Section 5

Impacts and Risks Evaluation Summary														
	Environmental Value Potentially Impacted							***Evaluation***						
Source of Risk	***Soil and Groundwater***	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***
Loss of hydrocarbons to marine environment due to a vessel collision			X		X	X	X	A	D	1	**M**	LCS GP PJ	Broadly Acceptable	EPO 5

Description of Source of Risk

Background

The temporary presence of the AHV and support vessel in the Operational Area will result in a navigational hazard for commercial shipping within the immediate area (as discussed in Section 6.6.1). This navigational hazard could result in a third party vessel colliding with the AHV or support vessel which could release hydrocarbons.

Support vessels have multiple isolated diesel tanks typically located mid-ship, and can range in typical size from 22 to 275 m^3. The maximum fuel tank size of the AHV is considered to be 264 m^3.

Industry Experience

Registered vessels or foreign flag vessels in Australian waters are required to report events to the Australian Transport Safety Bureau (ATSB), AMSA or Australian Search and Rescue (AusSAR).

From a review of the ATSB marine safety and investigation reports relevant to oil and gas industry vessels conducted for this EP (ATSB, 2013), one vessel collision occurred in 2011/12 that resulted in a spill of 25–30 L of oil into the marine environment as a result of a collision between a tug and support vessel off Barrow Island. Two other vessel collisions occurred in 2010, one in the port of Dampier, where a support vessel collided with a barge being towed. Minor damage was reported and no significant injury to personnel or pollution occurred. The second 2010 vessel collision involved a vessel under pilot control in port connecting with a vessel alongside a wharf, causing it to sink. No reported pollution resulted from the sunken vessel. These incidents demonstrate the likelihood of only minor volumes of hydrocarbons being released during the highly unlikely event of a vessel collision.

From 2010 to 2011, the ATSB's annual publication defines the individual safety action factors identified in marine accidents and incidents: 42% related to navigation action (2011). Of those, 15% related to poor communication and 42% related to poor monitoring, checking and documentation (ATSB, 2011). The majority of these related to the grounding instances.

Credible Scenario

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

- The identified causes of vessel interaction must result in a collision.
- The collision must have enough force to penetrate the vessel hull.
- The collision must be in the exact location of the fuel tank.
- The fuel tank must be full, or at least of volume which is higher than the point of penetration.

The probability of the chain of events described above aligning, to result in a breach of fuel tanks resulting in a spill that could potentially affect the marine environment, is considered remote. Given the offshore location of the Operational Area, vessel grounding is not considered a credible risk.

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

A collision between the AHV or support vessel and a third party was considered credible, although unlikely given the slow speeds of support vessels when relocating within the Operational Area. The maximum volume to be assumed in the assessment is therefore 275 m³ of marine diesel, which corresponds to rupture of the largest single tank inventory of a support vessel.

Quantitative Hydrocarbon Risk Assessment

Modelling of a 550 m^3 surface release of marine diesel was available for Woodside's Balnaves Development, conducted in 2016. The release location used for the spill modelling is located about 51 km north-west of the Montebello Islands and about 5 km from the Gemtree Operational Area. The modelled spill volume of 550 m^3 is greater than the worst-case credible release volume of 275 m^3 for this hydrocarbon spill risk assessment. However, the results of the modelling can be used to demonstrate that a much larger marine diesel spill in the vicinity of the Operational Area has an EMBA that is not predicted to include any surface slicks above threshold volumes entering WA state waters, or any shoreline contact or accumulation. Basing the impact assessment for a vessel collision scenario on this modelling is considered highly conservative and consequently, the EMBA for a 275 m^3 surface release of marine diesel within the Operational Area would be considerably smaller than the EMBA described in this EP.

The modelling assessed the extent of a marine diesel spill volume of 550 m³ for all seasons, using an historic sample of wind and current data for the region. A total of 50 simulations for each season were modelled (four seasons in total). The modelling was conducted by RPS using a three-dimensional hydrocarbon spill trajectory and weathering model (SIMAP, Spill Impact Mapping and Analysis Program) (RPS 2016).

Hydrocarbon Characteristics

Marine diesel is a mixture of both volatile and persistent hydrocarbons. Predicted weathering of marine diesel, based on typical conditions in the region, indicates that about 35% by mass would be expected to evaporate over the first 24 hours (Figure 6-1) (RPS 2019). After this time the majority of the remaining hydrocarbon is entrained into the upper water column, leaving only a small proportion of the oil floating on the water surface (<1%). Given the large proportion of entrained oil and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay and/or evaporate over time scales of several weeks to a few months, thereby extending the area of potential effect.

Given the environmental conditions experienced in the Operational Area, marine diesel is expected to undergo rapid spreading and this, together with evaporative loss, is likely to result in a rapid dissipation of the spill. Marine diesel distillates tend not to form emulsions at the temperatures found in the region. The characteristics of the marine diesel are given in Table 6-5.

Table 6-5: Characteristics of the marine diesel

Hydrocarbon type	Initial density (g/cm³) at 25 ºC	Viscosity (cP @ 25 ºC)	Component BP (ºC)	Volatiles %<180	Semi volatiles % 180–265	Low volatility (%) 265-380	Residual (%) >380
				Non-Persistent			Persistent
Marine diesel	0.829	4.0	% of total	6	34.6	54.4	5

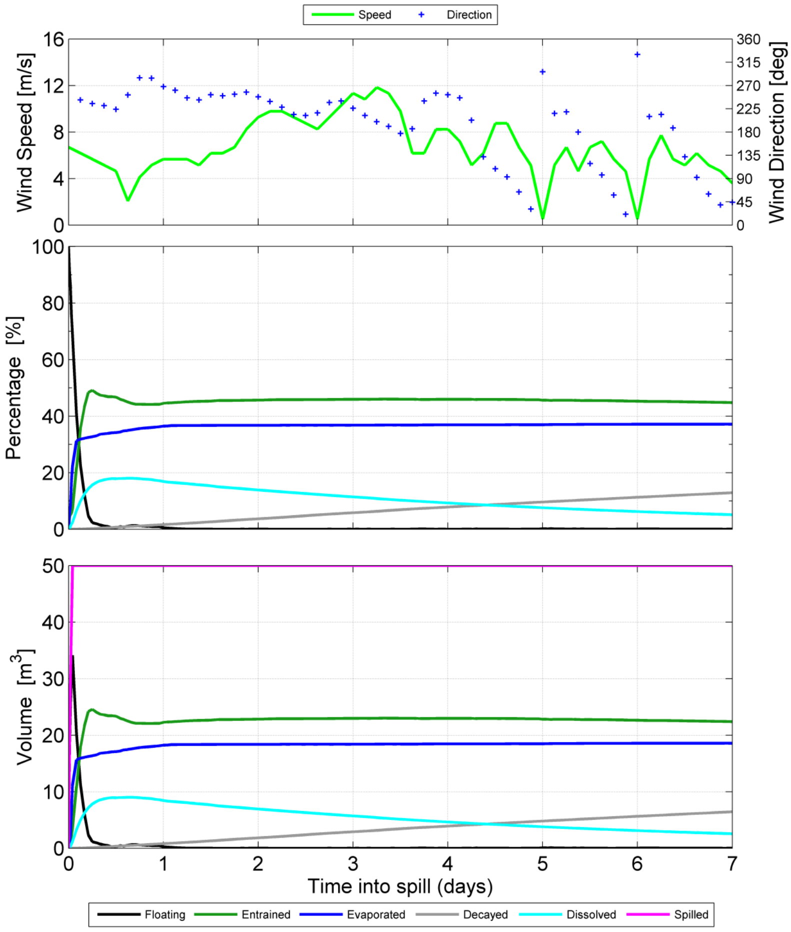

Figure 6-1: Proportional mass balance plot representing weathering of a 2000 m³ surface spill of marine diesel as a one-off release (at a rate of 50 m³/hr) and subject to variable wind at 27 °C water temperature and 25 °C air temperature (RPS 2019)

Impact Assessment

Potential Impacts Overview

Environment that May Be Affected

Surface Hydrocarbons: Quantitative hydrocarbon spill modelling results for surface hydrocarbons are shown in Table 6-6. If this scenario occurred, a surface hydrocarbon slick would form down-current of the release location, with the trajectory dependent on prevailing wind and current conditions at the time. The modelling indicates that the EMBA would be confined to open water, with surface hydrocarbons extending up to about 85 km from the release location at or above the 10 g/m² impact threshold.

A socio-cultural EMBA for surface hydrocarbons which includes the threshold for visible surface hydrocarbons of 1 g/m^2 may extend up to about 180 km from the release site.

Entrained Hydrocarbons: Quantitative hydrocarbon spill modelling results are shown in Table 6-6. If this vessel collision scenario occurred, a plume of entrained hydrocarbons would form down-current of the release location, with the trajectory dependent on prevailing current conditions at the time. The modelling indicates that locations exposed to entrained hydrocarbons at or above the threshold concentration of 500 ppb are restricted to offshore areas up to about 160 km from the release site. Table 6-6 provides details of receptors potentially contacted by entrained diesel at 500 ppb.

Dissolved Hydrocarbons: Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 500 ppb threshold are predicted to be limited to the immediate vicinity of the spill site and are not expected to reach any sensitive receptor habitats (Table 6-6).

Accumulated Hydrocarbons: Accumulated hydrocarbons above threshold concentrations (≥100 g/m²) were not predicted by the modelling to occur at any location.

Table 6-6: Probability of hydrocarbon spill contact above impact thresholds within the EMBA with key receptor locations and sensitivities for a 550 m³ Instantaneous release of marine diesel

Environmental setting	Location/name	Environmental, Social, Cultural, Heritage and Economic Aspects presented as per the Environmental Risk Definitions in Woodside's Risk Management Procedure																													Probability of hydrocarbon contact (diesel) (%) note: the probability is based on stochastic modelling of 200 hypothetical worst-case spills under a variety of weather and metocean conditions				
		Physic-al		Biological																						Socio-economic and Cultural									
		Water Quality	*Sediment Quality*	*Marine Primary Producers*			*Other Communities/Habitats*								*Protected Species*									*Other Species*											
		Open water (pristine)	*Marine sediment (pristine)*	*Coral reef*	*Seagrass beds/macroalgae*	*Mangroves*	*Spawning/nursery areas*	*Open water – productivity/ upwelling*	*Non-biogenic coral reefs*	*Offshore filter feeders and/or deepwater benthic communities*	*Nearshore filter feeders*	*Sandy shores*	*Estuaries/tributaries/creeks/ lagoons (including mudflats)*	*Rocky shores*	*Cetaceans – migratory whales*	*Cetaceans – dolphins and porpoises*	*Dugongs*	*Pinnipeds (sea lions and fur seals)*	*Marine turtles (including foraging and internesting areas and significant nesting beaches)*	*Seasnakes*	*Whale sharks*	*Sharks and rays*	*Sea birds and/or migratory shorebirds*	*Pelagic fish populations*	*Resident/demersal fish*	*Fisheries – commercial*	*Fisheries – traditional*	*Tourism and recreation*	*Protected areas/heritage – European and Indigenous/shipwrecks*	*Offshore oil & gas infrastructure (topside and subsea)*	*Surface hydrocarbon (1-10 g/m²)*	*Surface hydrocarbon (≥10 g/m²)*	*Entrained hydrocarbon (≥500 ppb)*	*Dissolved aromatic hydrocarbon (≥500 ppb)*	*Accumulated hydrocarbons (>100 g/m²)*
Offshore	Montebello AMP	✓	✓	✓			✓	✓							✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓*		12	9	2		
	Gascoyne AMP	✓	✓												✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			1		
Submerged Shoals	Rankin Bank	✓	✓	✓			✓	✓		✓						✓				✓	✓	✓		✓	✓	✓		✓			1				

Summary of Potential Impacts to Environmental Values
Summary of Potential Impacts to Protected Species
Marine Mammals
Marine mammals that have direct physical contact with surface, entrained or dissolved aromatic hydrocarbons may suffer surface fouling, ingestion of hydrocarbons (from prey, water and sediments), aspiration of oily water or droplets, and inhalation of toxic vapours (DWH Natural Resource Damage Assessment Trustees, 2016). This may result in the irritation of sensitive membranes such as the eyes, mouth, digestive and respiratory tracts and organs, impairment of the immune system, neurological damage (Helm et al., 2015), reproductive failure, adverse health effects (e.g. lung disease, poor body condition) and potentially mortality (DWH Natural Resource Damage Assessment Trustees, 2016). In a review of cetacean observations relating to a number of large scale hydrocarbon spills, Geraci (1988) found little evidence of mortality associated with hydrocarbon spills. However, it was concluded that exposure to oil from the Deepwater Horizon (DWH) resulted in increased mortality to cetaceans in the Gulf of Mexico (DWH Natural Resource Damage Assessment Trustees, 2016). Geraci (1988) did identify behavioural disturbance (i.e. avoiding spilled hydrocarbons) in some instances for several species of cetacean, suggesting that cetaceans have the ability to detect and avoid surface slicks. However, observations during spills have recorded larger whales (both mysticetes and odontocetes) and smaller delphinids travelling through and feeding in oil slicks. During the DWH spill, cetaceans were routinely seen swimming in surface slicks offshore (and nearshore) (Aichinger Dias et al., 2017). Impacts to cetaceans will depend on the exposure pathway; with exposure to entrained oil and surface slicks not expected to result in significant impacts due to the relatively volatile, non-persistent nature of the hydrocarbons. Direct toxic effects from external exposure are not expected to occur, although mucous membranes and eyes may become irritated. Indirect toxic effects, such as hydrocarbon ingestion through accumulation in prey, may occur. Baleen whales feeding within entrained hydrocarbon plumes may ingest hydrocarbons, potentially resulting in toxic effects (particularly fresh hydrocarbons near the release location). This is expected to be limited in migrating baleen whales, such as pygmy blue and humpback whales, which are known to primarily feed in the Southern Ocean (although may opportunistically feed during migrations). A range of cetaceans were identified as potentially occurring within the Operational Area and EMBA (Section 4.5.2). In the event of a vessel spill of MDO, surface, entrained and dissolved hydrocarbons exceeding threshold concentrations may drift across habitat for oceanic cetacean species and the migratory routes and BIAs of cetaceans considered to be MNES (Section 4.5.2), including humpback whales and pygmy blue whales (northbound and southbound migrations). Pygmy blue whales and humpback whales are known to migrate seasonally through the potential spill affected- area for surface, dissolved and entrained hydrocarbons (Section 4.5.2). A major spill in May to November would coincide with humpback whale migration through the waters off the Kimberley, and Pilbara (open ocean). A major spill in April to August or October to late January would coincide with pygmy blue whale migration. Double et al. (2014) suggest that pygmy blue whales migrate in offshore waters in the region of the Operational Area in about 200–1000 m of water (Figure 4-8). The pygmy blue whale migration BIA overlaps the Operational Area; and the humpback whale migration BIA within the EMBA may be overlapped by a worst-case hydrocarbon spill. Feeding during migrations is low level and opportunistic, reducing the potential for ingestion of hydrocarbons. Sub-lethal impacts from external exposure are therefore more likely. Migrations of both pygmy blue whales and humpback whales are protracted through time and space (i.e. the whole population will not be within the EMBA), and as such, a worst-case vessel spill of MDO is unlikely to affect an entire population. Cetacean populations that are resident within the potential EMBA may be susceptible to impacts from spilled hydrocarbons if they interact with an area affected by a spill. Impacts from physical contact with hydrocarbons are likely to be in the form of irritation and sub-lethal biological effects (e.g. skin irritation, reproductive failure) and in rare circumstances, death. Suitable habitat for oceanic toothed whales (e.g. sperm whales) and dolphins is broadly distributed throughout the region and as such, impacts from the spatial extent of a single spill trajectory (as opposed to the full EMBA) are unlikely to affect an entire population. Other species identified in Section 4.5.2) may also have possible transient interactions with the EMBA (refer Section 4.5.2 for the list of receptor locations important for cetaceans). Physical contact with hydrocarbons to these species may result in biological consequences. However, it is noted that -spilled hydrocarbon is expected to weather quickly beyond the release location, thereby reducing the potential for impact with increasing distance. Based on the assessment above, a worst-case vessel spill of MDO could disrupt a number of migrating humpback or pygmy blue whales, or other cetaceans. Such disruption could include behavioural impacts (e.g. avoidance of impacted areas), sub-lethal biological effects (e.g. skin irritation, irritation from ingestion or inhalation, reproductive failure) and, in rare circumstances, death. Given that impacts are expected to be largely sub-lethal, such disruptions or impacts are not predicted to impact on the overall population viability of cetaceans within offshore waters of the EMBA.
Marine Reptiles
Marine Turtles: Adult turtles exhibit no avoidance behaviour when they encounter hydrocarbon slicks (NOAA, 2010). Contact with surface slicks, or entrained hydrocarbon, can therefore result in hydrocarbon adherence to body surfaces (Gagnon and Rawson, 2010) irritating mucous membranes in the nose, throat and eyes leading to inflammation and

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

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

Due to the absence of potential nesting habitat and location offshore, the Operational Area is unlikely to represent important habitat for marine turtles. However, turtles may be present foraging within the EMBA, and the EMBA overlaps the habitat critical to the survival of a species internesting buffer for flatback turtles, BIAs identified in Section 4.5.2, particularly the internesting BIAs for flatback turtles which extend for ~80 km from known nesting locations.

In the event of a worst case vessel spill of MDO, there is a potential that surface and entrained hydrocarbons exceeding impact threshold concentrations (10 g/m^2 and 500 ppb respectively) will be present in offshore waters extending up to 85 km and 160 km respectively, from the release site. It is therefore not expected to form surface slicks in areas where turtles are likely to occur in high densities (e.g. near nesting areas, foraging habitat, etc.). Inhalation of harmful concentrations of hydrocarbon vapour by turtles is therefore expected to be limited. Furthermore, toxicity of hydrocarbons will be significantly reduced by weathering at over such distances, with the volatile and water soluble (often the most toxic) components expected to have dissipated beyond the vicinity of the spill site. Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 500 ppb threshold are also predicted to be limited to the immediate vicinity of the spill site.

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

Seasnakes: Impacts to seasnakes from direct contact with hydrocarbons are likely to result in similar physical effects to those recorded for marine turtles and may include potential damage to the dermis and irritation to mucus membranes of the eyes, nose and throat (International Tanker Owners Pollution Federation (ITOPF), 2011). They may also be impacted when they return to the surface to breathe and inhale the toxic vapours associated with the hydrocarbons, damaging their respiratory system.

In general, seasnakes frequent the waters of the continental shelf area around offshore islands and potentially submerged shoals such as Rankin Bank (although Rankin Bank is not predicted to be contacted by hydrocarbons above ecological impact thresholds). While individuals may be present in the offshore oceanic waters, their abundance is not expected to be high, given the deep water and offshore location of the activity. Therefore, a hydrocarbon spill may have a minor disruption to a portion of the population in offshore oceanic waters.

Sharks and Rays

Hydrocarbon contact may affect whale sharks through ingestion (entrained/dissolved hydrocarbons), particularly if feeding. Whale sharks may transit offshore open waters, including the Operational Area and EMBA, when migrating to and from Ningaloo Reef (Figure 4-11), where they aggregate for feeding from March to July. Whale sharks may also opportunistically feed in offshore waters and the EMBA overlaps the whale shark migration BIA identified in Section 4.5.2. Whale sharks are seasonally present within the BIA between April and October. Whale sharks are versatile feeders, filtering large amounts of water over their gills, catching planktonic and nektonic organisms (Jarman and Wilson, 2004). Therefore, individual whale sharks that have direct contact with hydrocarbons within the spill affected- area may be impacted.

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

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

Seabirds and Migratory Shorebirds
Seabirds and/or Migratory Shorebirds: Offshore waters are potential foraging grounds for seabirds associated with coastal roosting and nesting habitat. There are confirmed foraging grounds off the Barrow/Montebello/Lowendal Island Group. A BIA for wedge-tailed shearwaters overlaps the EMBA, as provided in Section 4.5.2.8. Seabirds generally do not exhibit avoidance behaviour to floating hydrocarbons. Physical contact of seabirds with surface slicks is by several exposure pathways, primarily immersion, ingestion and inhalation. Such contact with hydrocarbons may result in plumage fouling and hypothermia (loss of thermoregulation), decreased buoyancy and potential to drown, inability to fly or feed, anaemia, pneumonia and irritation of eyes, skin, nasal cavities and mouths (AMSA, 2013; International Petroleum Industry Environmental Conservation Association (IPIECA), 2004) and result in mortality due to oiling of feathers or the ingestion of hydrocarbons. Longer term exposure effects that may potentially impact seabird populations include a loss of reproductive success (loss of breeding adults) and malformation of eggs or chicks (AMSA, 2013). The extent of the EMBA for surface hydrocarbon concentration of >10 g/m^2, as a result of a worst-case vessel spill of MDO, is simulated by stochastic modelling to extend about 100 km from the release location (at 1% probability and above). Therefore, a hydrocarbon spill is unlikely to disrupt a significant portion of the foraging habitat for seabirds.
Summary of Potential Impacts to Other Species
Pelagic and Demersal Fish
Pelagic and Demersal Fish: Fish mortalities are rarely observed to occur as a result of hydrocarbon spills (ITOPF, 2011). This has generally been attributed to the possibility that pelagic fish are able to detect and avoid surface waters underneath hydrocarbon spills by swimming into deeper water or away from the affected areas. Fish that have been exposed to dissolved aromatic hydrocarbons are capable of eliminating the toxicants once placed in clean water, hence individuals exposed to a spill are likely to recover (King et al., 1996). Where fish mortalities have been recorded, the spills (resulting from the groundings of the tankers Amoco Cadiz in 1978 and the Florida in 1969) have occurred in sheltered bays (Conan, 1982 & Sanders et al., 1980). Laboratory studies have shown that adult fish are able to detect hydrocarbons in water at very low concentrations, and large numbers of dead fish have rarely been reported after oil spills (Hjermann et al., 2007). This suggests that juvenile and adult fish are capable of avoiding water contaminated with high concentrations of hydrocarbons. However, sub-lethal impacts to adult and juvenile fish may be possible, given long-term exposure (days to weeks) to PAH concentrations (Hjermann et al., 2007). It is noted that modelling of the worst-case vessel spill of MDO indicates the potential EMBA for dissolved hydrocarbons is limited to the immediate vicinity of the spill location. No time-integrated exposure metrics were modelled, but would show an even smaller area of potential impact. Given the oceanographic environment within the EMBA and small EMBA for dissolved hydrocarbons, PAH exposures in the order of weeks for pelagic fish are not considered credible. The effects of exposure to oil on the metabolism of fish appears to vary according to the organs involved, exposure concentrations and route of exposure (waterborne or food intake). Oil reduces the aerobic capacity of fish exposed to aromatics in the water and to a lesser extent affects fish consuming contaminated food (Cohen et al., 2005). The liver, a major detoxification organ, appears to be the organ where anaerobic activity is most impacted, probably increasing anaerobic activity to facilitate the elimination of ingested oil from the fish (Cohen et al., 2005). Fish are perhaps most susceptible to the effects of spilled oil in their early life stages, particularly during egg and planktonic larval stages, which can become entrained in spilled oil. Contact with oil droplets can mechanically damage feeding and breathing apparatus of embryos and larvae (Fodrie and Heck, 2011). The toxic hydrocarbons in water can result in genetic damage, physical deformities and altered developmental timing for larvae and eggs exposed to even low concentrations over prolonged timeframes (days to weeks) (Fodrie and Heck, 2011). More subtle, chronic effects on the life history of fish as a result of exposing early life stages to hydrocarbons include disruption to complex behaviour such as predator avoidance, reproductive and social behaviour (Hjermann et al., 2007). Prolonged exposure of eggs and larvae to weathered concentrations of hydrocarbons in water has also been shown to cause immunosuppression and allows expression of viral diseases (Hjermann et al., 2007). PAHs have also been linked to increased mortality and stunted growth rates of early life history (pre-settlement) of reef fishes, as well as behavioural impacts that may increase predation of post-settlement larvae (Johansen et al., 2017). However, the effect of a hydrocarbon spill on a population of fish in an area with fish larvae and/or eggs, and the extent to which any of the adverse impacts may occur, depends greatly on prevailing oceanographic and ecological conditions at the time of the spill and its contact with fish eggs or larvae. Mortality and sub lethal effects may impact pelagic fish in an area close to the spill location within the EMBA for entrained/dissolved aromatic hydrocarbons (500 ppb). Demersal fish species are associated with the Continental Slope Demersal Fish Communities KEF and Ancient Coastline at 125 m Depth Contour KEF, which overlap the Operational Area and EMBA respectively and provide habitat for demersal fish species. However, impacts to demersal fish are not considered likely given the water depths of the Operational and EMBA and that a surface spill of MDO would be limited to entrainment in the upper 20 to 30 m of the water column.

<table>
<tr><td colspan="2">Summary of Potential Impacts to Marine Primary Producers</td></tr>
<tr><td colspan="2">Receptor Group</td></tr>
<tr><td colspan="2">There are a few very small patches in the EMBA that are shallower than 30 m (over 50 km from the Operational Area) which may potentially support sparse seagrass or macroalgae habitat. At this distance hydrocarbons are expected to be highly weathered and impacts to marine primary producers are not expected.</td></tr>
<tr><td colspan="2">Summary of Potential Impacts to Other Habitats and Communities</td></tr>
<tr><td colspan="2">Receptor Group</td></tr>
<tr><td colspan="2">Benthic Fauna Communities: Impacts to benthic fauna communities are not considered credible given the water depths of the Operational Area and the majority of the EMBA and that a surface spill of MDO would be limited to entrainment in the upper 20 to 30 m of the water column. There are a few very small patches in the EMBA that are shallower than 30 m, over 50 km from the Operational Area. At this distance hydrocarbons are expected to be highly weathered and impacts to benthic fauna communities are not expected.</td></tr>
<tr><td colspan="2">Open Water – Productivity/Upwelling: Primary production by plankton (triggered by sporadic upwelling events in the offshore waters of the NWS) is an important component of the primary marine food web. Planktonic communities are generally mixed including phytoplankton (cyanobacteria and other microalgae) and secondary consuming zooplankton (crustaceans (e.g. copepods) and the eggs and larvae of fish and invertebrates (meroplankton). Exposure to hydrocarbons in the water column can change species composition, with declines or increases in one or more species or taxonomic groups (Batten et al., 1998). Phytoplankton may also experience decreased rates of photosynthesis (Tomajka, 1985). For zooplankton, direct effects of contamination may include suffocation, changes in behaviour, or environmental changes that make them more susceptible to predation. Impacts on plankton communities are likely to occur in areas where surface, entrained or dissolved aromatic hydrocarbon threshold concentrations are exceeded, but communities are expected to recover relatively quickly (within weeks or months). This is due to high population turnover with copious production within short generation times that also buffers the potential for long-term (i.e. years) population declines (ITOPF, 2011). Therefore, any impacts are likely to be on exposed planktonic communities present in the EMBA and temporary.</td></tr>
<tr><td>Key Ecological Features</td><td>KEFs potentially impacted by the hydrocarbon spill from a worst-case vessel spill of MDO are:
• Continental Slope Demersal Fish Communities
• Ancient Coastline at 125 m Depth Contour

These KEFs are primarily defined by seabed geomorphological features and are described to identify the potential for increased biological productivity and, therefore, ecological significance. However, given the water depths of the Operational and the majority of the EMBA and that a surface spill of MDO would be limited to entrainment in the upper 20 to 30 m of the water column, impacts to the defined values (benthic habitats and demersal species) of the KEFs are not expected (for the values of each KEF see Section 4.7.3).</td></tr>
<tr><td colspan="2">Summary of Potential Impacts to Water Quality</td></tr>
<tr><td colspan="2">Open Water – Water Quality: Water quality would be affected due to hydrocarbon contamination which is described in terms of the biological effect concentrations. These are defined by the EMBA descriptions for each of entrained and dissolved hydrocarbon fates and their predicted extent (refer to Table 6-6). Furthermore, given the volatile nature and rapid weathering and dispersal of MDO, water quality is predicted to have only minor long term and/or significant short term hydrocarbon contamination above background and/or national/international quality standards.</td></tr>
<tr><td colspan="2">Summary of Potential Impacts to Protected Areas (Including AMPs)</td></tr>
<tr><td colspan="2">The quantitative spill risk assessment results indicate that the open water environment protected within the Commonwealth Australian Marine Parks (AMPs) listed in Table 6-6 may be affected by the released hydrocarbons in the unlikely event of a worst-case vessel spill of MDO. It is noted that there are no State protected areas within the EMBA.

The Montebello AMP has the potential to be contacted by surface hydrocarbons (9% probability) and entrained hydrocarbons (2% probability) at or above the defined ecological effect concentrations (10 g/m^2 and 500 ppb respectively). The modelling also predicts a 1% probability of the Gascoyne AMP being contacted by entrained hydrocarbons (≥ 500 ppb). There are no other AMPs within the EMBA.

Hydrocarbons that are predicted to reach these protected areas will be in an advanced state of weathering and at concentrations typically associated with lethal and sub-lethal impacts to only the most sensitive marine organisms. The potential (albeit low probability) of visible surface hydrocarbons exceeding 1 g/m^2 reaching the Montebello AMP may result in a perception from stakeholders and the public of more significant impacts than actually occur.</td></tr>
</table>

Objectives in the management plans for AMPs within the EMBA require consideration of a number of physical, ecological, socio-economic and heritage values identified in these areas (Section 4.7). Impact on the values of these AMPs are discussed in the relevant sections above for ecological and physical values and below for socio-economic and heritage values.

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

Summary of Potential Impacts to Socio-economic Values (including AMPs)

Fisheries – Commercial: The spill scenario modelled is unlikely to cause significant direct impacts on the target species of Commonwealth and offshore State fisheries within the defined EMBA, except for those occurring in close proximity to the release location. Indirect impacts may occur through the contamination of prey organisms near the release site and the subsequent ingestion of this prey, which could result in long term impacts to fish as a result of bioaccumulation. Further details are provided below (impact assessment relating to spawning is discussed above under *Summary of Potential Impacts to Other Habitats and Communities*).

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

Western Tuna and Billfish, Southern Bluefin Tuna, Western Skipjack and West Australian Mackerel Fisheries: The Commonwealth-managed tuna and billfish fisheries (Western Tuna and Billfish, Western Skipjack Southern Bluefin Tuna fisheries, for which limited fishing activity has occurred in this area in recent years) and the Western Australian Mackerel Fishery target pelagic fish species. Adult fish are highly mobile and able to move away from the spill-affected area or avoid the surface waters; however, hydrocarbon concentrations in the upper water column could lead to potential exposure through direct absorption of hydrocarbons and indirectly by the consumption of contaminated prey (Merkel et al., 2012). Given these pelagic species are distributed over a wide geographical area, the impacts at the population or species level are considered minor in the unlikely event of a spill. The Western Tuna and Billfish Fishery targets waters near Carnarvon, and the WA Mackerel Managed Fishery targets nearshore waters. These are both outside the EMBA therefore, impacts or tainting to target fish species is not expected. Similarly, fishing activity for the southern bluefin tuna and western skipjack tuna are not expected within the Operational Area or EMBA (Table 4-7).

Western Deep Trawl and Northwest Slope Trawl Fisheries: The predicted EMBA resulting from a worst-case vessel spill of MDO overlaps with waters fished by the Commonwealth-managed Northwest Slope Trawl Fishery and Western Deep Trawl Fishery. These fisheries target demersal and benthic species (demersal finfish and crustaceans) in greater than 200 m water depth. Hydrocarbons are not predicted to occur in these water depths and so target species are not expected to be impacted. The North West Slope Trawl Fishery may be temporarily affected by the establishment of a fishing exclusion zone for an extended period, however, the fishery typically comprises one or two vessels that target waters along more than 1,000 km of the continental slope. Any fishing exclusion zone would apply to a more localised area, therefore, fishing vessels may initially need to move to alternative fishing grounds but fishing would not be prevented completely.

Other State-Managed Fisheries**:** The predicted EMBA resulting from a major spill may impact the area fished by a number of State fisheries (refer Table 4-7). These fisheries generally use a range of gear types (trawl, trap and line) and operate from shallow inshore water to water depths up to 200 m, targeting demersal and pelagic finfish species and prawns. In the unlikely event of a major hydrocarbon spill, there is the potential for the targeted fish species to be exposed to entrained and/or dissolved aromatic hydrocarbons in the water column. However, the potential for direct impact would be reduced, as target species such as mackerel and snapper are likely to avoid the surface water layer underneath oil slicks. Demersal and benthic species (such as finfish and crustaceans) have limited mobility and therefore will not be able to easily move away from a spill. Mortality/sub-lethal effects may impact populations located close to the vessel spill location. A major spill of hydrocarbons from the Petroleum Activities Program may lead to an exclusion of fishing from the spill-affected area for an extended period.

A number of other State and Commonwealth fisheries, further afield in the EMBA (refer Table 4-7), may also be affected by a major spill. However, the impacts to these far field fisheries will be similar to that described above for 'General Fisheries Impacts'.

Offshore Oil and Gas Infrastructure: In the unlikely event of a major spill, surface hydrocarbons may affect production from existing petroleum facilities (platforms and floating production, storage and offtake vessels). For example, facility water intakes for cooling and fire hydrants could be shut off which could in turn lead to the temporary cessation of production activities. Spill exclusion zones established to manage the spill could also prohibit support vessel access. The impact on ongoing operations of regional production facilities would be determined by the nature and scale of the spill and metocean conditions. Furthermore, decisions on the operation of production facilities in the event of a spill would be based primarily on health and safety considerations. The closest production is the Pluto Platform (operated by Woodside). Other nearby facilities include the Chevron-operated Wheatstone Platform. Operation of these facilities is likely to be affected in the event of a worst-case vessel spill of MDO.
Worst case Potential Impacts to Social and Environmental Values
In the unlikely event of a major hydrocarbon spill due to a worst-case vessel spill of MDO, the EMBA (including the socio-cultural EMBA) includes the areas listed in Table 6-6. This the Montebello AMP, Gascoyne AMP and Rankin Bank. The probability of contact with hydrocarbons above impact thresholds is low at all locations (maximum probability of 12 % contact above 1 g/m^2 surface hydrocarbons at the Montebello AMP). Predicted probability of contact at Gascoyne AMP and Rankin Bank is 1%. Given the open ocean location of these sensitive areas and the degree of weathering of hydrocarbons by the time there is contact, impacts including socio-cultural effects are expected to be minor and temporary. Potential impacts on species and habitats in the EMBA may be minor and short-term. Based on the assessment above and given the volatile and non-persistent nature of the hydrocarbons, the extent of impacts is not expected to result in a threat to the overall viability of species populations in the wider region. As such, the overall environmental consequence is defined as D, which equates to minor, short term impact (1–2 years) on species, habitat (but not affecting ecosystems), physical or biological attributes (Table 2-3). The likelihood of the event is defined as a 1 'Highly Unlikely', resulting in a risk rating of Moderate.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[18]***	***Benefit in Impact/ Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 30 (prevention of collisions) 2016, including: • adherence to steering and sailing rules including maintaining lookouts (e.g. visual, hearing, radar, etc.), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar) • adherence to navigation light display requirements, including visibility, light position/shape appropriate to activity • adherence to navigation noise signals as required.	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed reduce the likelihood of interference with other marine users resulting in a collision.	Controls based on legislative requirements – must be adopted.	Yes C 5.1
Marine Order 21 (safety and emergency arrangements) 2016, including: • adherence to minimum safe manning levels • maintenance of navigation equipment in efficient working order (compass/radar)	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed reduce the likelihood of interference with other marine users and thus the likelihood of a collision.	Controls based on legislative requirements – must be adopted.	Yes C 5.2

[18] Qualitative measure

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[18]	***Benefit in Impact/ Risk Reduction***	***Proportionality***	***Control Adopted***
• navigational systems and equipment required are those specified in Regulation 19 of Chapter V of *Safety of Life at Sea* • Automatic Identification System (AIS) that provides other users with information about the vessel's identity, type, position, course, speed, navigational status and other safety-related data.				
Good Practice				
Notify AHS of activities and movements no less than four working weeks prior to the scheduled activity commencement date.	F: Yes. CS: Minimal cost. Standard practice.	Notification to AHS will enable them to generate navigation warnings (Maritime Safety Information Notifications (MSIN) and Notice to Mariners (NTM) (including AUSCOAST warnings where relevant)).	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes C 1.1
Notify AMSA JRCC of activities and movements of the activity 24–48 hours before operations commence.	F: Yes. CS: Minimal cost. Standard practice.	Communication of the Petroleum Activities Program to other marine users ensures they are informed and aware, thereby reducing the likelihood of a collision with a third party vessel.	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes C 1.3
Mitigation: Oil spill response.	Refer to Appendix D.			
Professional Judgement – Eliminate				
Eliminate use of vessels.	F: No. The use of vessels is required to conduct the Petroleum Activities Program. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[18]	***Benefit in Impact/ Risk Reduction***	***Proportionality***	***Control Adopted***
Risk Based Analysis				
A quantitative spill risk assessment was performed (see detail above).				
ALARP Statement On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the adopted controls appropriate to manage the impacts and risks of an unplanned loss of hydrocarbon as a result of vessel collision. As no reasonable additional/alternative controls were identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that an unplanned loss of hydrocarbon as a result of a vessel collision represents a low current risk rating that is unlikely to result in potential impact greater than localised, minor and temporary disruption to a small proportion of the population and no impact on critical habitat or activity. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are consistent with the most relevant regulatory guidelines, good oil-field practice/industry best practice and meet legislative requirements of Marine Orders 30 and 21. The potential impacts and risks are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts and risks of a loss of vessel structural integrity to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 5 No release of hydrocarbons to the marine environment due to a vessel collision during the Petroleum activities Program.	**C 5.1** Marine Order 30 (prevention of collisions) 2016, including: • adherence to steering and sailing rules including maintaining lookouts (e.g. visual, hearing, radar, etc.), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar) • adherence to navigation light display requirements, including visibility, light position/shape appropriate to activity • adherence to navigation noise signals as required.	**PS 5.1** AHV and support vessel compliant with Marine Order 30 (which requires vessels to be visible at all times) to prevent unplanned interaction with marine users.	**MC 5.1.1** Marine Assurance inspection records demonstrate compliance with standard maritime safety procedures (Marine Orders 21 and 30).
	C 5.2 Marine Order 21 (safety of emergency arrangements) 2016, including: • adherence to minimum safe manning levels • maintenance of navigation equipment in efficient working order (compass/radar)	**PS 5.2** AHV and support vessel compliant with Marine Order 21 to prevent unplanned interaction with marine users.	

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	• navigational systems and equipment required are those specified in Regulation 19 of Chapter V of *Safety of Life at Sea* • AIS that provides other users with information about the vessel's identity, type, position, course, speed, navigational status and other safety-related data.		
	C 1.1 Notify AHS of activities and movements no less than four working weeks before prior to the scheduled activity commencement date.	**PS 1.1** Notification to AHS of activities and movements to allow generation of navigation warnings (Maritime Safety Information Notifications (MSIN) and Notice to Mariners (NTM) (including AUSCOAST warnings where relevant)).	**MC 1.1.1** Consultation records demonstrate that AHS has been notified before commencing the activity to allow generation of navigation warnings (MSIN and NTM (including AUSCOAST warnings where relevant)).
	C 1.3 Notify AMSA JRCC of activities and movements of the activity 24–48 hours before operations commence.	**PS 1.3** Notification to AMSA JRCC to prevent activities interfering with other marine users. AMSA's JRCC will require the AHV's details (including name, callsign and MMSI), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels and need to be advised when operations start and end.	**MC 1.3.1** Consultation records demonstrate that AMSA JRCC has been notified before commencing the activity within required timeframes.
Detailed preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are presented in Appendix D.			

6.7.3 Unplanned Discharges: Deck and Subsea Spills

Context	
Project vessels – Section 3.5	Physical environment – Section 4.4 Biological environment – Section 4.5

Impacts and Risks Evaluation Summary														
Source of Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***
Accidental discharge to the ocean of other hydrocarbons/ chemicals from project vessel deck activities and equipment (e.g. cranes), including subsea spills			X		X	X		A	F	2	**L**	LCS GP	Broadly Acceptable	EPO 6

Description of Source of Risk
Deck spills can result from spills from stored hydrocarbons/chemicals or equipment. Project vessels (AHV and support vessel) will typically store hydrocarbon/chemicals in small volumes (e.g. 20 L, 205 L). Storage areas are typically set up with effective primary and secondary bunding to contain any deck spills. Releases from equipment are predominantly from the failure of hydraulic hoses, which can either be located within bunded areas or outside of bunded or deck areas (e.g. over water on cranes). Subsea spills can result from a loss of containment of fluids from subsea equipment including the ROV. The ROV hydraulic fluid is supplied through hoses containing about 20 L of fluid. Hydraulic lines to the ROV arms and other tooling may become caught, resulting in minor leaks to the marine environment. Small volume hydraulic leaks may occur from equipment operating via hydraulic controls subsea (subsea control fluid). These include the diamond wire cutter, bolt tensioning equipment, ROV tooling, etc. Woodside's operational experience demonstrates that spills are most likely to originate from hydraulic hoses and have been less than 100 L, with an average volume <10 L.

Impact Assessment
Potential Impacts to Water Quality, Other Habitats and Communities and Protected Species
Accidental spills of hydrocarbons or chemicals from project vessels would decrease the water quality in the immediate area of the spill; however, the impacts would be expected to be temporary and very localised due to the volumes, dispersion and dilution in the open ocean environment. Given the offshore/open water location, receptors such as marine fauna may only be affected if they come in direct contact with a release (i.e. by traversing the immediate spill area). If marine fauna come into contact with a release they could suffer fouling, ingestion, inhalation of toxic vapours, irritation of sensitive membranes in the eyes, mouth, digestive and respiratory tracts and organ or neurological damage. Cetaceans may exhibit avoidance behaviour patterns and given they are smooth skinned, hydrocarbons and other chemicals are not expected to adhere. Given the small area of the potential spill and the dilution and weathering of any spill, the likelihood of ecological impacts to marine fauna (protected species), other communities and habitats is unlikely. No impacts on socio-economic receptors are expected due to the low levels of fishing activity in the Operational Area, the small volumes of hydrocarbons/chemicals that could be accidentally spilled, and the localised and temporary nature of the impacts.

Summary of Potential Impacts to Environmental Values
Given the adopted controls, it is considered that other hydrocarbon/chemical spills to the marine environment will not result in a potential impact greater than localised and temporary on species, habitat (but not affecting ecosystems function), physical and biological attributes (i.e. Environment Impact – F).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/ Sacrifice (CS)***[19]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 91 (marine pollution prevention—oil) 2014, requires Shipboard Oil Pollution Emergency Plan (SOPEP) (as appropriate to vessel class).	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed reduce the likelihood of an unplanned release. The consequence is unchanged.	Controls based on legislative requirements – must be adopted.	Yes C 6.1
Liquid chemical and fuel storage areas are bunded or secondarily contained when they are not being handled/moved temporarily.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of contaminated deck drainage water being discharged to the marine environment.	Controls based on legislative requirements – must be adopted.	Yes C 6.2
Good Practice				
Spill kits positioned in high risk locations around the rig (near potential spill points such as transfer stations).	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of a deck spill from entering the marine environment. The consequence is unchanged.	Benefits outweigh cost/sacrifice.	Yes C 6.3
Project vessels have self-containing hydraulic oil drip tray management system.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of a deck spill from entering the marine environment. The consequence is unchanged.	Benefits outweigh cost/sacrifice.	Yes C 6.4
Detailed oil spill preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are presented in Appendix D.				
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
Below-deck storage of all hydrocarbons and chemicals.	F: Not feasible. During operations there is a need to keep small volumes near activities and within equipment requiring use of hydrocarbons and chemicals and can result in increased risk of leaks from	Not considered – control not feasible.	Not considered – control not feasible.	No

[19] Qualitative measure

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/ Sacrifice (CS)***[19]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	transfers via hose or smaller containers. CS: Not considered – control not feasible.			

ALARP Statement

On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the adopted controls appropriate to manage the impacts and risks of the potential unplanned accidental deck and subsea spills described above. As no reasonable additional/alternative controls were identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.

Demonstration of Acceptability

Acceptability Statement

The impact assessment has determined that an unplanned minor discharge of hydrocarbons as a result of minor deck and subsea spills represents a low current risk rating that is unlikely to result in potential impact greater than localised and temporary disruption to a small proportion of the population and no impact on critical habitat or activity. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are consistent with the most relevant regulatory guidelines and good oil-field practice/industry best practice. The potential impacts and risks are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts and risks of minor unplanned deck and subsea spills to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 6 No unplanned spills to the marine environment from deck activities greater than a consequence level of F[20] during the Petroleum Activities Program.	**C 6.1** Marine Order 91 (marine pollution prevention—oil) 2014, requires SOPEP (as appropriate to vessel class).	**PS 6.1** Appropriate initial responses prearranged and drilled in case of a hydrocarbon spill, as appropriate to vessel class.	**MC 6.1** Marine assurance inspection records demonstrate compliance with Marine Order 91.
	C 6.2 Liquid chemical and fuel storage areas are bunded or secondarily contained when they are not being handled/ moved temporarily.	**PS 6.2** Failure of primary containment in storage areas does not result in loss to the marine environment.	**MC 6.2** Records confirms all liquid chemicals and fuel are stored in bunded/ secondarily contained areas when not being handled/moved temporarily.
	C 6.3 Spill kits positioned in high risk locations around the rig (near potential spill points such as transfer stations).	**PS 6.3** Spill kits to be available for use to clean up deck spills.	**MC 6.3** Records confirms spill kits are present, maintained and suitably stocked.

[20] Defined as 'Slight, short term local impact (< 1 year), on species, habitat but not affecting ecosystem function), physical or biological attributes' as in **Figure 2-6**/**Section 2.6.3**.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	C 6.4 Project vessels have self-containing hydraulic oil drip tray management system.	**PS 6.4** Contain any on-deck spills of hydraulic oil.	**MC 6.4** Records demonstrate project vessels are equipped with self-containing hydraulic oil drip tray management system.

6.7.4 Unplanned Discharges: Loss of Solid Hazardous and Non-hazardous Wastes/Equipment

Context	
Project vessels – Section 3.5	Physical environment – Section 4.4 Biological environment – Section 4.5

Impacts and Risks Evaluation Summary														
	Environmental Value Potentially Impacted							***Evaluation***						
Source of Risk	***Soil and Groundwater***	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***
Accidental loss of hazardous or non-hazardous wastes/ equipment to the marine environment (excludes sewage, grey water, putrescible waste and bilge water)			X		X	X		A	F	2	**L**	LCS GP	Broadly Acceptable	EPO 7

Description of Source of Risk
The project vessels will generate a variety of solid wastes including packaging and domestic wastes such as aluminium cans, bottles, paper and cardboard. Hence, there is the potential for solid wastes to be lost overboard to the marine environment. Equipment that has been recorded as being lost on previous vessel campaigns (primarily windblown or dropped overboard) has included the loss of a metal pole and hardhat. Loss of solid wastes has potential to occur during periods of adverse weather and incorrect waste storage.

Impact Assessment
Potential Impacts to Water Quality, Other Habitats and Communities and Protected Species
The potential impacts of solid wastes accidentally discharged to the marine environment include direct pollution and contamination of the environment and secondary impacts relating to potential contact of marine fauna with wastes, resulting in entanglement or ingestion and leading to injury and death of individual animals. The temporary or permanent loss of waste materials into the marine environment environmental impact is expected to be of no lasting effect, based on the location of the Operational Area, the types, size and frequency of wastes that could occur and species present.
Summary of Potential Impacts to Environmental Values
Given the adopted controls, it is considered that the accidental discharge of solid waste described will result in localised impacts not significant to environmental receptors (i.e. Environment Impact – F).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[21]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 95 – marine pollution prevention—garbage (as appropriate to vessel class), prescribes matters necessary to give effect to Annex V of MARPOL, which prohibits the discharge of all garbage into the sea, except as provided otherwise.	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed reduces the likelihood of an unplanned release. The consequence is unchanged.	Controls based on legislative requirements – must be adopted.	Yes C 7.1
Good Practice				
Project vessel waste arrangements, which require: • dedicated waste segregation bins • records of all waste to be disposed, treated or recycled • waste streams to be handled and managed according to their hazard and recyclability class.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of an unplanned release. The consequence is unchanged.	Benefit outweighs cost sacrifice.	Yes C 7.2
Project vessels or the ROV may be used to attempt recovery of hazardous solid wastes lost overboard. Where safe and practicable, this activity will consider: • risk to personnel to retrieve object • whether the location of the object is in recoverable water depths • object's proximity to subsea infrastructure • ability to recover the object (i.e. nature of object, lifting equipment or, ROV availability and suitable weather).	F: Yes. CS: Minimal cost. Standard practice.	Occurs after an unplanned release of solid waste and therefore no change to the likelihood. Since the waste objects may be recovered, a reduction in consequence is possible.	Benefit outweighs cost sacrifice.	Yes C 7.3
Professional Judgement – Eliminate				
No additional controls identified.				

[21] Qualitative measure.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[21]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the adopted controls appropriate to manage the impacts and risks of accidental discharges of waste. As no reasonable additional/alternative controls were identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that, given the adopted controls, accidental discharge of solid waste represents a low current risk rating that is unlikely to result in a potential impact above localised and no lasting impacts on species, habitat (but not affecting ecosystems function), physical and biological attributes. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice and meet legislative requirements (Marine Order 95). The potential impacts and risks are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts and risks of these discharges to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 7 No unplanned releases of solid hazardous or non-hazardous waste to the marine environment greater than a consequence level of F during the Petroleum Activities Program.	**C 7.1** Marine Order 95 – marine pollution prevention—garbage (as appropriate to vessel class), prescribes matters necessary to give effect to Annex V of MARPOL, which prohibits the discharge of all garbage into the sea, except as provided otherwise.	**PS 7.1** Project vessels compliant with Marine Order 95.	**MC 7.1** Records demonstrate project vessels are compliant with Marine Order 95.
	C 7.2 Project vessels waste arrangements which require: • dedicated waste segregation bins • records of all waste to be disposed, treated or recycled • waste streams to be handled and managed according to their hazard and recyclability class.	**PS 7.2** Hazardous and non-hazardous waste will be managed in accordance with the project vessel waste arrangements.	**MC 7.2** Records demonstrate compliance against project vessel waste arrangements.
	C 7.3 Project vessels, ROV or crane may be used to attempt recovery of hazardous solid wastes lost overboard.	**PS 7.3** Any hazardous solid waste dropped to the marine environment will be recovered	**MC 7.3** Records detail the recovery attempt consideration and status of any hazardous

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	Where safe and practicable, this activity will consider: • risk to personnel to retrieve object • whether the location of the object is in recoverable water depths • object's proximity to subsea infrastructure • ability to recover the object (i.e. nature of object, lifting equipment or, ROV availability and suitable weather).	where safe and practicable to do so.	waste lost to marine environment.

6.7.5 Physical Presence: Vessel Collision with Marine Fauna

Context														
Project vessels – Section 3.5								Biological environment – Section 4.5						
Impacts and Risks Evaluation Summary														
Source of Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***
Accidental collision between project vessels and protected marine fauna						X		A	E	1	**L**	LCS PJ	Broadly Acceptable	EPO 8
Description of Source of Risk														

Project vessels operating in and around the Operational Area may present a potential hazard to protected marine fauna, including cetaceans (e.g. pygmy blue whales), whale sharks and marine turtles. Vessel movements can result in collisions between the vessel (hull and propellers) and marine fauna, potentially resulting in superficial injury, serious injury that may affect life functions (e.g. movement and reproduction) and mortality. Factors that contribute to the frequency and severity of impacts due to collision vary greatly due to vessel type, vessel operation (specific activity, speed), physical environment (e.g. water depth), the type of animal potentially present and their behaviours.

The AHV will be limited to a very small area while performing anchor hold testing activities, and will travel at low speed when transiting between test locations. The support vessel, if required, will typically be stationary or moving at low speeds when supporting AHV operations. The support vessel may transit to and from the Operational Area between two and four trips per week (e.g. to port) when the AHV is present in the Operational Area.

Impact Assessment

Potential Impacts to protected species

The likelihood of vessel/whale collision being lethal is influenced by vessel speed; the greater the speed at impact, the greater the risk of mortality (Jensen and Silber, 2004; Laist et al., 2001). Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale as a result of a vessel strike increases from about 20% at 8.6 knots to 80% at 15 knots. At a speed of four knots, the risk was estimated to be less than 10%. Vessel–whale collisions at this speed are uncommon and, based on reported data contained in the NOAA database (Jensen and Silber, 2004), there are only two known instances of collisions when the vessel was travelling at less than six knots. Both of these were from whale watching vessels that were deliberately placed among whales.

Project vessels in the Operational Area are likely to be travelling less than eight knots; therefore, the chance of a vessel collision with protected species resulting in a lethal outcome is significantly reduced versus faster moving vessels. No known key aggregation areas (resting, breeding or feeding) for protected species are located within or immediately adjacent to the Operational Area; however, the following BIAs overlap with the Operational Area:

- Pygmy blue whale partial overlap with the migration BIA (Figure 4-8). Seasonally present April to August (north bound migration) and October to late January (south bound migration).
- Whale shark foraging BIA (Figure 4-11). Seasonally present between March and July during migrations to and from Ningaloo Reef. Occasionally individuals may occur at other times of the year.

Flatback turtle internesting BIA (Figure 4-10). Seasonally present during the nesting season between October and March. Occasionally individuals may occur at other times of the year. • An area designated as habitat critical to the survival of flatback turtles (internesting buffer) overlaps the Operational Area. The activity could occur at any time throughout the year (all seasons); therefore, it is possible that the activity will overlap with the seasonal presence of the species discussed above and there may be increased numbers of individuals of these species within the Operational Area during the seasonal periods described above. Whale sharks are at risk from vessel strikes when feeding at the surface or in shallow waters (where there is limited option to dive). Whale sharks may traverse offshore NWS waters including the Operational Area during their migrations to and from Ningaloo Reef and whale sharks have been tracked moving across the Operational Area. However, it is expected that whale shark presence within the Operational Area would not comprise significant numbers, given there is no main aggregation area within the vicinity of the Operational Area, and their presence would be transitory and of a short duration. The 60 km internesting buffer identified as habitat critical to the survival of flatback turtles in the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017) is based primarily on the movements of tagged internesting flatback turtles along the NWS reported by Whittock et al. (2014), which found that flatback turtles may demonstrate internesting displacement distances up to 62 km from nesting beaches. However, these movements were confined to longshore movements in nearshore coastal waters or travel between island rookeries and the adjacent mainland (Whittock et al. 2014). A more recent paper by the same authors (Whittock et al. 2016) has more precisely defined flatback turtle internesting habitat along the NWS. Whittock et al. (2016) defined suitable internesting habitat as water 0–16 m deep and within 5–10 km of the coastline, while unsuitable internesting flatback habitat was defined as waters >25 m deep and >27 km from the coastline. There is no evidence to date to indicate flatback turtles swim out into deep offshore waters during the internesting period. With consideration of the absence of potential nesting or foraging habitat (i.e. no emergent islands, reef habitat or shallow shoals) and the water depth in the Operational Area (at least ~166 m), it is highly unlikely the Operational Area represents important internesting or foraging habitat for any species of marine turtle. It is acknowledged that there are significant nesting sites along the mainland coast and islands of the region. It is unlikely that vessel movement associated with the Petroleum Activities Program will have a significant impact on marine fauna populations, given: (1) the low presence of transiting individuals; (2) avoidance behaviour commonly displayed by whales, whale sharks and turtles; (3) low operating speed of the project vessels (generally less than eight knots or stationary in the Operational Area, unless operating in an emergency) and (3) the short duration (up to 14 days) of the activity.
Summary of Potential Impacts to Environmental Values
Given the adopted controls, it is considered that a collision, were it to occur, will not result in a potential impact greater than slight, short term impact on species (i.e. Environment Impact – E).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/ Sacrifice (CS)[22]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans, including the following measures[23]: • Project vessels will not travel faster than six knots within 300 m of a cetacean or turtle (caution zone) and not approach closer than 100 m from a whale.	F: Yes. CS: Minimal cost. Standard practice.	Implementation of these controls will reduce the likelihood of a collision between a cetacean, whale shark or turtle occurring. The consequence of a	Controls based on legislative requirements – must be adopted.	Yes C 8.1

[22] Qualitative measure.

[23] For safety reasons, the distance requirements below are not applied for a vessel holding station or with limited manoeuvrability; e.g. anchor handling, loading, back-loading, bunkering, close standby cover for overside working and emergency situations.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/ Sacrifice (CS)***[22]	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
• Project vessels will not approach closer than 50 m for a dolphin or turtle and/or 100 m for a whale (with the exception of animals bow-riding). • If the cetacean or turtle shows signs of being disturbed, project vessels will immediately withdraw from the caution zone at a constant speed of less than six knots. • Vessels will not travel faster than eight knots within 250 m of a whale shark and not allow the vessel to approach closer than 30 m of a whale shark.		collision is unchanged.		
Good Practice				
No additional controls identified.				
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
The use of dedicated MFOs on the project vessels for the duration of each activity to watch for whales and provide direction on and monitor compliance with Part 8 of the EPBC Regulations.	F: Yes, however vessel bridge crews already maintain a constant watch during operations. CS: Additional cost of MFOs considered unnecessary.	Given support vessel bridge crews already maintain a constant watch during operations, additional MFOs would not significantly further reduce the risk.	Disproportionate. The cost/sacrifice outweighs the benefit gained.	No
ALARP Statement On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the adopted controls appropriate to manage the impacts and risks of potential vessel collision with protected marine fauna. As no reasonable additional/alternative controls were identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement
The impact assessment has determined that, given the adopted controls, vessel collision with marine fauna represents a low current risk rating that is unlikely to result in a potential impact greater than slight and short-term disruption to a small proportion of the population and no impact on critical habitat or activity. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice and meet the requirements of Part 8 (Division 8.1) of the EPBC Regulations 2000. The potential impacts and risks are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts and risks of vessel collision with marine fauna to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 8 No vessel strikes with protected marine fauna (whales, whale sharks, turtles) during the Petroleum Activities Program.	**C 8.1** EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans, including the following measures[24]: • Project vessels will not travel faster than six knots within 300 m of a cetacean or turtle (caution zone) and not approach closer than 100 m from a whale. • Project vessels will not approach closer than 50 m for a dolphin or turtle and/or 100 m for a whale (with the exception of animals bow-riding). • If the cetacean or turtle shows signs of being disturbed, project vessels will immediately withdraw from the caution zone at a constant speed of less than six knots. • Vessels will not travel faster than eight knots within 250 m of a whale shark and not allow the vessel to approach closer than 30 m of a whale shark.	**PS 8.1.1** Compliance with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.05 and 8.06) Interacting with cetaceans to minimise potential for vessel strike.	**MC 8.1.1** Records demonstrate no breaches of EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans.
		PS 8.1.2 All vessel strike incidents with cetaceans will be reported in the National Ship Strike Database (as outlined in the Conservation Management Plan for the Blue Whale Commonwealth of Australia, 2015).	**MC 8.1.2** Records demonstrate reporting cetacean ship strike incidents to the National Ship Strike Database.

[24]For safety reasons, the distance requirements below are not applied for a vessel holding station or with limited manoeuvrability; e.g. anchor handling, loading, back-loading, close standby cover for overside working and emergency situations.

6.7.6 Physical Presence: Dropped Object Resulting in Seabed Disturbance

Context	
Project vessels – Section 3.5	Physical Environment – Section 4.4 Biological environment – Section 4.5

Impacts and Risks Evaluation Summary

Source of Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	*Marine Sediment*	*Water Quality*	*Air Quality (incl Odour)*	*Ecosystems/Habitat*	*Species*	*Socio-Economic*	*Decision Type*	*Consequence*	*Likelihood*	*Current Risk Rating*	*ALARP Tools*	*Acceptability*	*Outcome*
Dropped objects resulting in seabed disturbance					X			A	F	2	**L**	GP	Broadly Acceptable	EPO 9

Description of Source of Risk
There is the potential for objects to be dropped overboard from the project vessels to the marine environment. Objects that have been dropped during previous offshore projects include small numbers of personnel protective gear (e.g. glasses, gloves, hard hats), small tools (e.g. spanners) and hardware fixtures.

Impact Assessment

Potential Impacts to Other Benthic Communities

In the unlikely event of loss of equipment or materials to the marine environment, potential environmental effects would be limited to localised physical impacts on benthic communities. As a result of recovery of any dropped objects, this impact will be temporary in nature. However, if the object cannot be recovered due to health and safety, operational constraints and other factors (locating dropped objects at depth) then the slight impact will be long term.

The temporary or permanent loss of dropped objects into the marine environment is not likely to have a significant environmental impact, as the benthic communities associated with the Operational Area are of low sensitivity and are broadly represented throughout the NWMR (Section 4.5.1). One KEF – the Continental Slope Demersal Fish Communities – has been identified as overlapping the Operational Area, as described in Section 4.7.3. Given only a very small proportion of the KEF is overlapping the Operational Area, and the nature and scale of impacts and risks from dropped objects, seabed sensitivities associated with this KEF will not be significantly impacted. Further, considering the types, size and frequency of dropped objects that could occur, it is unlikely that a dropped object would have a significant impact on any benthic community.

Summary of Potential Impacts to Environmental Values

Given the adopted controls and the predicted small footprint of a dropped object, it is considered that a dropped object will result in only localised impacts to a small area of the seabed and a small proportion of the benthic population; however, no significant impact to environmental receptors and with no lasting effect (i.e. Environment Impact – F).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/ Sacrifice (CS)[25]***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
The project vessels work procedures for lifts and cargo loading, which require: • the security of loads to be checked prior to commencing lifts • loads to be covered if there is a risk of losing loose materials • lifting operations to be conducted using the Permit to Work (PTW) and Job Safety Analysis (JSA) systems to manage the specific risks of that lift, including consideration of weather and sea state.	F: Yes. CS: Minimal cost. Standard practice.	Occurs after a dropped object event and therefore no change to the likelihood. Since the object may be recovered, a reduction in consequence is possible.	Benefits outweigh cost/sacrifice.	Yes C 9.1
Project vessel inductions include control measures and training for crew in dropped object prevention.	F: Yes. CS: Minimal cost. Standard practice.	By ensuring crew are appropriately trained in dropped object prevention, the likelihood of a dropped object event is reduced. No change in consequence will occur.	Benefits outweigh cost/sacrifice.	Yes C 9.2
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A), Woodside considers the adopted controls appropriate to manage the impacts and risks of seabed disturbance from dropped objects. As no reasonable additional/alternative controls were identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

[25] Qualitative measure

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that, given the adopted controls, dropped objects will not result in a potential impact greater than a localised disruption to a small area of the seabed, a small proportion of the benthic population and no impact on critical habitat or activity. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice. The potential impacts and risks are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts and risks of seabed disturbance from dropped objects to an acceptable level.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 9 No incidents of dropped objects to the marine environment greater than a consequence level of F[26] during the Petroleum Activities Program.	**C 9.1** The project vessel work procedures for lifts cargo loading, which require: • the security of loads to be checked prior to commencing lifts • loads to be covered if there is a risk of losing loose materials • lifting operations to be conducted using the PTW and JSA systems to manage the specific risks of that lift, including consideration of weather and sea state.	**PS 9.1** All lifts conducted in accordance with applicable project vessel work procedures to limit potential for dropped objects.	**MC 9.1** Records show lifts conducted in accordance with the applicable project vessel work procedures.
	C 9.2 Project vessel inductions include control measures and training for crew in dropped object prevention.	**PS 9.2** Awareness of requirements for dropped object prevention.	**MC 9.2** Records show dropped object prevention training is provided to the project vessels.

[26] Defined as 'Slight, short term local impact (<1 year), on species, habitat but not affecting ecosystem function), physical or biological attributes' as in **Figure 2-6/Section 2.6.3**.

6.7.7 Physical Presence: Accidental Introduction and Establishment of Invasive Marine Species

Context		
Project vessels – Section 3.5	Physical environment – Section 4.4 Biological environment – Section 4.5	Stakeholder consultation – Section 5

Impacts and Risks Evaluation Summary														
	Environmental Value Potentially Impacted							***Evaluation***						
Source of Risk	***Soil and Groundwater***	***Marine Sediment***	***Water Quality***	***Air Quality (incl Odour)***	***Ecosystems/Habitat***	***Species***	***Socio-Economic***	***Decision Type***	***Consequence***	***Likelihood***	***Current Risk Rating***	***ALARP Tools***	***Acceptability***	***Outcome***
Introduction of invasive marine species (IMS)					X	X	X	A	D	0	L	LCS GP PJ	Broadly Acceptable	EPO 10

Description of Source of Risk
IMS are a subset of Non-indigenous Marine Species (NIMS) that have been introduced into a region beyond their natural biogeographic range, resulting in impacts to social/cultural, human health, economic and/or environmental values. NIMS are species that have the ability to survive, reproduce and establish founder populations. However, not all NIMS introduced into an area will thrive or cause demonstrable impacts. The majority of NIMS around the world are relatively benign and few have spread widely beyond sheltered ports and harbours. During the Petroleum Activities Program, vessels will be transiting to and from the Operational Area, potentially including traffic mobilising from beyond Australian waters. There is the potential for project vessels to transfer IMS from either international waters or Australian waters into the Operational Area. All vessels are subject to some level of marine fouling. Organisms attach to the vessel hull, particularly in areas where organisms can find a good attachment surface (e.g. seams, strainers and unpainted surfaces) or where turbulence is lowest (e.g. niches, sea chests, etc.). Commercial vessels typically maintain anti-fouling coatings to reduce the build-up of fouling organisms. Organisms can also be drawn into ballast tanks during onboarding of ballast water required to maintain safe operating conditions. During the Petroleum Activities Program, project vessels have the potential to introduce IMS to the Operational Area through biofouling (containing IMS) on vessels, as well as ballast water exchange (as described above). Cross--contamination between vessels can also occur (e.g. IMS translocated between project vessels).

Impact Assessment
Potential Impacts to Ecosystems/Habitats, Species and Socio-economic Values
Potential IMS have historically been introduced and translocated around Australia by a variety of natural and human means including biofouling and ballast water. Potential IMS vary from one region to another depending on various environmental factors such as water temperature, salinity, nutrient levels and habitat type, which dictate their survival and invasive capabilities. IMS typically require hard substrate in the photic zone, therefore requiring shallow waters to become established. Highly-disturbed, shallow-water environments such as shallow coastal waters, ports and marinas are more susceptible to IMS colonisation, whereas IMS are generally unable to successfully establish in deep water ecosystems and open-water environments where the rate of dilution and the degree of dispersal are high (Williamson and Fitter, 1996; Paulay et al., 2002; Geiling, 2014). The undisturbed, deep water, offshore location of the Operational Area is therefore unlikely to represent suitable habitat for the establishment of IMS.

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

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

While project vessels have the potential to introduce IMS into the Operational Area, the deep offshore open waters of the Operational Area (166–511 m) are not conducive to the settlement and establishment of IMS. Furthermore, the Operational Area is away from shorelines and/or critical habitat. The nearest sensitive receptor is the Montebello Marine Park located 11 km east of the Operational Area at its nearest point. The northern portion of the Montebello AMP closest to the Operational Area is in water depths greater than 50 m, with the shallower nearshore waters of the Montebello Islands about 51 km from the Operational Area. Therefore, it is not expected that settlement and establishment of IMS within the Marine Park could occur as a result of the Petroleum Activities Program. The likelihood of IMS being introduced and establishing viable populations within the Operational Area or surrounds is considered remote.

Summary of Potential Impacts to Environmental Values

In support of Woodside's assessment of the impacts and risks of IMS introduction associated with the Petroleum Activities Program, Woodside conducted a risk and impact evaluation of the different aspects of a marine pest translocation. The results of this assessment are presented in Table 6-7.

As a result of this assessment, Woodside has presented the highest potential consequence as a D and likelihood as Remote (0), resulting in an overall low risk following the implementation of identified controls.

Table 6-7: Evaluation of risks and impacts from marine pest translocation

IMS introduction location	Credibility of introduction	Consequence of introduction	Likelihood
Introduced to Operational Area and establishment on the seafloor or subsea structures.	**Not Credible** The deep offshore open waters of the Operational Area are located away from shorelines and/or critical habitat, more than 25 nm from a shore and in waters 166–511 m deep; they are therefore not conducive to the settlement and establishment of IMS.		
Introduced to Operational Area and establishment on a project vessel.	**Credible** There is potential for the transfer of marine pests between project vessels within the Operational Area.	**Environment – Not Credible** The translocation of IMS from a colonised project vessel to shallower environments via natural dispersion is not considered credible, given the distances of the Operational Area from nearshore environments (i.e. greater than 12 nm/50 m water depth). There is therefore no credible environmental risk and the assessment is limited to Woodside's reputation and brand. **Reputation – D** If IMS were to establish on a project vessel this could potentially impact the vessel operationally through the fouling of intakes, result in translocation of an IMS into the Operational Area and, depending on the species, potentially transfer of an IMS to other support vessels, which would likely result in the quarantine of the vessel until eradication could occur (through cleaning and treatment of infected areas), which would be costly to perform. Such introduction would be expected to have minor impact to Woodside's reputation, particularly with Woodside's contractors, and would likely have a reputational impact on future proposals.	**Remote (0)** Interactions between project vessels will be limited during the Petroleum Activities Program, with the single AHV and optional support vessel. Interactions would be limited to short periods of time. There is also no direct contact (i.e. they are not tied up alongside) during these activities. Spread of marine pests via ballast water in these open ocean environments is also considered remote due to lack of suitable habitat for settlement and establishment.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***[27]	***Benefit in Impact/ Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Project vessels will manage their ballast water using one of the approved ballast water management options, as specified in the Australian Ballast Water Management Requirements.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of transferring marine pests between project vessels within the Operational Area. No change in consequence would occur.	Controls based on legislative requirements under the *Biosecurity Act 2015* – must be adopted.	Yes C 10.1
Good Practice				
IMS risk assessment process applied to project vessels which enter the Operational Area. Based on the outcomes of each IMS risk assessment, management measures commensurate with the risk (such as the treatment of internal systems, IMS inspections or cleaning) will be implemented to minimise the likelihood of IMS being introduced.	F: Yes. CS: Minimal cost. Good practice implemented across all Woodside Operations.	Identifies potential risks and additional controls implemented accordingly. In doing so, the likelihood of transferring marine pests between project vessels within the Operational Area is reduced. No change in consequence would occur.	Benefits outweigh cost/sacrifice.	Yes C 10.2
Professional Judgement – Eliminate				
No discharge of ballast water during the Petroleum Activities Program.	F: No. Ballast water discharges are critical for maintaining vessel stability. Given the nature of the Petroleum Activities Program, the use of ballast (including the potential discharge of ballast water) is considered to be a safety -critical requirement. CS: Not assessed, control not feasible.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Eliminate use of vessels.	F: No. Given vessels must be used to implement the project, there is no feasible means to eliminate the source of risk. CS: Loss of the project.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Professional Judgement – Substitute				
Source project vessels based in Australia only.	F: Potentially. Limiting activities to only use local project vessels could potentially pose a	Sourcing vessels from within Australia will reduce the likelihood of IMS from	Disproportionate. Sourcing vessels from Australian waters may result in	No

[27] Qualitative measure.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)[27]***	***Benefit in Impact/ Risk Reduction***	***Proportionality***	***Control Adopted***
	significant risk in terms of time and duration of sourcing a vessel, as well as the ability of the local vessels to perform the required tasks. There are limited AHVs based in Australian waters. While the project will attempt to source support vessels locally, it is not always possible. Availability cannot always be guaranteed when considering competing oil and gas activities in the region. In addition, sourcing Australian based vessels only will cause increases in cost due to pressures of vessel availability. CS: Significant cost and schedule impacts due to restrictions of vessel hire opportunities.	outside Australian waters; however, it does not reduce the likelihood of translocation of species native to Australia but alien to the Operational Area and NWMR, or of IMS that have established elsewhere in Australia. The consequence is unchanged.	a reduction in the likelihood of IMS introduction to the Operational Area; however, the potential cost of implementing this control is grossly disproportionate to the minor environmental gain (or reducing an already remote likelihood of IMS introduction) potentially achieved by using only Australian based vessels. Consequently, this risk is considered not reasonably practicable.	
IMS Inspection of all vessels.	F: Yes. Approach to inspect vessels could be a feasible option. CS: Significant cost and schedule impacts. In addition, the IMS risk assessment process (C 21.2) is seen to be more cost effective, as this control allows Woodside to manage the introduction of marine pests through biofouling, while targeting its efforts and resources to areas of greatest concern.	Inspection of all vessels for IMS would reduce the likelihood of IMS being introduced to the Operational Area. However, this reduction is unlikely to be significant given the other control measures implemented. No change in consequence would occur.	Disproportionate. The cost outweighs the benefit gained, as other controls will be implemented to achieve an ALARP position.	No
Professional Judgement – Engineered Solution				
None identified.				
ALARP Statement On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (e.g. Decision Type A), Woodside considers the adopted controls appropriate to manage the impacts and risks of IMS introduction. As no reasonable additional/alternative controls were identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Statement The impact assessment has determined that, given the adopted controls, translocation of IMS may result in a minor, short-term (1–2 years) impact with no lasting effect and the likelihood of introducing IMS to the Operational Area is considered remote[28]. Further opportunities to reduce the impacts and risks have been investigated above. The adopted controls are considered good oil-field practice/industry best practice. The potential impacts and risks are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts and risks of invasive marine species to an acceptable level.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 10 No introduction and establishment of invasive marine species into the Operational Area as a result of the Petroleum Activities Program.	**C 10.1** Project vessels will manage their ballast water using one of the approved ballast water management options, as specified in the Australian Ballast Water Management Requirements.	**PS 10.1** Prevents the translocation of IMS within the vessel's ballast water from high risk locations to the Operational Area.	**MC 10.1** Ballast Water Records System maintained by vessels which verifies compliance against Australian Ballast Water Management Requirements.
	C 10.2 IMS risk assessment process applied to project vessels which enter the Operational Area. Based on the outcomes of each IMS risk assessment, management measures commensurate with the risk (such as the treatment of internal systems, IMS inspections or cleaning) will be implemented to minimise the likelihood of IMS being introduced.	**PS 10.2** Minimise the likelihood of translocating IMS within a vessel's biofouling to the Operational Area.	**MC 10.2.1** Records of IMS risk assessments maintained for all project vessels conducting the Petroleum Activities Program.
			MC 10.2.2 Records of management measures which have been implemented where identified through the IMS vessel risk assessment process are maintained.

[28] All project vessels will undergo Woodside's IMS risk assessment process; therefore, the risk of introducing IMS to the Operational Area and then onto nearshore or coastal areas was considered not credible.

7 IMPLEMENTATION STRATEGY

7.1 Overview

Regulation 14 of the Environment Regulations requires an EP to contain an implementation strategy for the activity. The Implementation Strategy for the Petroleum Activities Program confirms fit-for-purpose systems, practices and procedures are in place to direct, review and manage the activities so environmental risks and impacts are continually being reduced to ALARP and are Acceptable, and that environmental performance outcomes and standards outlined in this EP are achieved.

Woodside, as nominated titleholder, is responsible for ensuring the Petroleum Activities Program is managed in accordance with this Implementation Strategy and the WMS (see Section 1.9).

7.2 Systems, Practice and Procedures

All operational activities are planned and performed in accordance with relevant legislation, standards and management measures identified in this EP, and internal environment standards and procedures (Section 4).

Processes are implemented to verify that:

- controls to manage environmental impacts and risks to ALARP and Acceptable are effective
- environmental performance outcomes are met
- standards defined in this EP are complied with.

The systems, practices and procedures that will be implemented are listed in the Performance Standards (PS) contained in this EP. Document names and reference numbers may be subject to change during the statutory duration of this EP and is managed through a changes register and update process.

7.3 Roles and Responsibilities

Key roles and responsibilities for Woodside and Contractor personnel relating to implementing, managing and reviewing this EP are described in Table 7-1. Roles and responsibilities for oil spill preparation and response are outlined in Appendix D and the *Woodside Oil Pollution Emergency Arrangements (Australia)*.

Table 7-1: Roles and responsibilities

Title (role)	Environmental Responsibilities
Office-based Personnel	
Woodside Well Delivery Manager (or delegate)	• Monitor and manage the activity so it is conducted as per the relevant standards and commitments in this EP. • Notify the Woodside Environmental Adviser of any scope changes in a timely manner. • Liaise with regulatory authorities as required. • Review this EP as necessary and manage change requests. • Ensure all project vessel crew members complete an HSE induction. • Verify that contractors meet environmental-related contractual obligations. • Confirm environmental incident reporting meets regulatory requirements (as outlined in this EP) and Woodside internal event recording, investigation and learning requirements. • Monitor and close out corrective actions identified during environmental monitoring or audits.

Title (role)	Environmental Responsibilities
Woodside Environmental Adviser	• Verify relevant Environmental Approvals for the activities exist prior to commencing activity. • Track compliance with performance outcomes and performance standards as per the requirements of this EP. • Prepare environmental component of relevant Induction Package. • Assist with reviewing, investigating and reporting environmental incidents. • Ensure environmental monitoring and inspections/audits are conducted as per the requirements of this EP. • Liaise with relevant regulatory authorities as required. • Assist in preparing external regulatory reports required, in line with environmental approval requirements and Woodside external regulatory reporting obligations. • Monitor and close out corrective actions (Campaign Action Register) identified during environmental monitoring or audits. • Provide advice to relevant Woodside personnel and contractors to assist them to understand their environment responsibilities. • Liaise with primary contractors to ensure communication and understanding of environment requirements as outlined in this EP and in line with Woodside's Compass values and management systems.
Woodside Corporate Affairs Adviser	• Prepare and implement the Stakeholder Consultation Plan for the Petroleum Activities Program. • Report on stakeholder consultation. • Perform ongoing liaison and notification as outlined in the EP.
Woodside Marine Assurance Superintendent	• Conduct relevant audit and inspection to confirm vessels are in compliance with relevant Marine Orders and Woodside requirements to meet safety, navigation and emergency response requirements.
Woodside Corporate Incident Coordination Centre (CICC) Duty Manager	On receiving notification of an incident: • Establish and take control of the Incident Management Team (IMT) and establish an appropriate command structure for the incident. • Assess the situation and identify risks and actions to minimise the risk. • Communicate impact, risk and progress to the Crisis Management Team and stakeholders. • Develop the incident action plan, including setting objectives for action. • Approve, implement and manage the incident action plan. • Communicate within and beyond the incident management structure. • Manage and review safety of responders. • Address the broader public safety considerations. • Conclude and review activities.
Vessel-based Personnel	
Vessel Master	• Ensure the vessel management system and procedures are implemented. • Ensure personnel commencing work on the vessel receive an environmental induction that meets the relevant requirements specified in this EP. • Ensure personnel are competent to perform the work they have been assigned. • Ensure SOPEP drills are conducted as per the vessel's schedule. • Ensure the vessel Emergency Response Team has been given sufficient training to implement the SOPEP. • Ensure any environmental incidents or breaches of relevant environmental performance outcomes or performance standards detailed in this EP are reported immediately to the Woodside Site Representative and tracked to closeout in a timely manner. Closeout of actions must be communicated to the Well Delivery Manager.

Title (role)	Environmental Responsibilities
Woodside Site Representative (or delegate)	• Support the Well Delivery Manager to ensure the controls detailed in this EP relevant to offshore activities are implemented on the vessel, and assist in collecting and recording evidence of implementation (other controls are implemented and evidence collected onshore). • Support the environmental advisor to ensure the environmental performance outcomes are met and the performance standards detailed in this EP are implemented on the vessel. • Ensure environmental incidents or breaches of outcomes or standards outlined in this EP are reported, and corrective actions for incidents and breaches are developed, tracked and closed out in a timely manner. • Ensure periodic environmental inspections/reviews are completed and corrective actions from inspections are developed, tracked and closed out in a timely manner. • Review Contractors' procedures, input into Toolbox talks and JSAs. • Provide day-to-day environmental support for activities in consultation with the Woodside Environmental Adviser.
Contractor Project Manager	• Confirm that activities are conducted in accordance with this EP, as detailed in the Woodside-approved Contactor environmental management plan (or equivalent). • Ensure personnel commencing work on the project receive a relevant environmental induction that meets the requirements specified in this EP. • Ensure personnel are competent to perform the work they have been assigned. • Ensure any environmental incidents or breaches of objectives, standards or criteria outlined in this EP are reported immediately to the Woodside Site Representative or Vessel Master.

It is the responsibility of all Woodside employees and contractors to implement the *Woodside Corporate Health, Safety, Environment and Quality Policy* (Appendix A) in their areas of responsibility and that the personnel are suitably trained and competent in their respective roles.

7.4 Training and Competency

7.4.1 Overview

Woodside as part of its contracting process assesses a proposed Contractor's environmental management system to determine the level of consistency with the standard AS/NZ ISO 14001. This assessment is conducted for the Petroleum Activities Program as part of the pre-mobilisation process. The assessment determines whether there is an organisational structure that clearly defines the roles and responsibilities for key positions. The assessment also determines whether there is an up-to-date training matrix that defines any corporate and site/activity-specific environmental training and competency requirements.

As a minimum, environmental awareness training is required for all personnel, detailing awareness and compliance with the Contractor's environmental policy and environmental management system.

7.4.2 Inductions

Inductions are provided to all relevant personnel (e.g. Contractors and Company representatives) before mobilising to or on arrival at the activity location. The induction covers the HSE requirements and environmental information specific to the activity location. Attendance records will be maintained.

The Petroleum Activities Program induction may cover information about:

- description of the activity
- ecological and socio-economic values of the activity location
- regulations relevant to the activity

- Woodside's Environmental Management System – Health Safety, Environment and Quality Policy
- EP importance/structure/implementation/roles and responsibilities
- main environmental aspects/hazards and potential environmental impacts and related performance outcomes
- oil spill preparedness and response
- monitoring and reporting on performance outcomes and standards using measurement criteria
- incident reporting.

7.4.3 Petroleum Activity Specific Environmental Awareness

Before commencing project activities associated with the Petroleum Activities Program, a pre-activity meeting will be held on the AHV with all relevant personnel. The pre-activity meeting provides an opportunity to reiterate specific environmental sensitivities or commitments associated with the activity. Relevant sections of the pre-activity meeting will also be communicated to the support vessel personnel, if required. Attendance lists are recorded and retained.

During operations, regular HSE meetings will be held on the project vessels. During these meetings, recent environmental incidents are reviewed and awareness material presented regularly.

7.4.4 Management of Training Requirements

All personnel on the project vessels are required to be competent to perform their assigned positions. This may be in the form of external or 'on-the-job' training. The vessel Safety Training Coordinator (or equivalent) is responsible for identifying training needs, keeping records of training undertaken, and identifying minimum training requirements.

7.5 Monitoring, Auditing, Management of Non-Conformance and Review

7.5.1 Monitoring

Woodside and its Contractors will conduct a program of periodic monitoring during the Petroleum Activities Program – starting at mobilisation of the activity and continuing through the duration of the activity to completion. This information will be collected using the tools and systems outlined below, developed based on the environmental performance outcomes, controls, standards and measurement criteria in this EP. The tools and systems will collect, as a minimum, the data (evidence) referred to in the measurement criteria in Section 6.6 and Section 6.7 and Appendix D.

The collection of this data (against the measurement criteria) will form part of the permanent record of compliance maintained by Woodside. It will form the basis for demonstrating that the environmental performance outcomes and standards are met, which will be summarised in a series of routine reporting documents.

7.5.1.1 Source-Based Impacts and Risks

The tools and systems to monitor environmental performance, where relevant, will include:

- daily reports, which include leading indicator compliance
- periodic review of waste management and recycling records
- collection of evidence of compliance with the controls detailed in the EP relevant to offshore activities by the Woodside Site Representative (or delegate) (other compliance evidence is collected onshore)

- monitoring of progress against the Drilling and Completions function scorecard for key performance indicators
- internal auditing and assurance program as described in Section 7.5.2.

Throughout this activity, Woodside will continuously identify new source-based risks and impacts through the Monitoring and Auditing systems and tools described above and in Section 7.5.2.

7.5.1.2 Receptor-Based Knowledge Updates

Under the Woodside Environmental Knowledge Management System, regular monitoring to maintain currency of receptor knowledge is performed as follows:

- Quarterly review of DoEE EPBC Act listed species status, listed species Recovery/Management and Conservation plans, and other environmental matters is completed and recorded by the Environment Science Team. The outcome of each review is summarised and issued to the relevant Environment personnel responsible for EP implementation for their consideration.
- Under the Oil Spill Scientific Monitoring Programme preparedness, an annual review and update to the environmental baseline studies database is completed and documented.
- Periodic location focused- environmental studies and baseline data gap analyses are completed and documented. Any subsequent studies scoped and executed as a result of such gap analysis are managed by the Environment Science Team and tracked via the Corporate Environment Baseline Database.

7.5.2 Auditing

Environmental performance auditing will be performed to:

- identify changes to existing or potential new environmental impacts and risk, and methods for reducing those to ALARP
- confirm that mitigation measures detailed in this EP are effectively reducing environmental impacts and risk, that mitigation measures proposed are practicable, and provide appropriate information to verify compliance
- confirm compliance with the commitments (performance outcomes, controls and standards) detailed in this EP.

The following internal auditing will be performed for the anchor hold test scope:

- A vessel based HSE inspection will be conducted by vessel Woodside Site Representative (or delegate). The inspection will focus on a specific risk area relevant to the project activity and a report will be issued.

The internal audits/inspections and reviews, combined with the ongoing monitoring described in Section 7.5.1, and collection of evidence for measurement criteria are used to assess environmental performance outcomes and standards.

As part of Woodside's Environmental Management System (EMS) and/or assurances processes, activities may also be periodically selected for environmental audits as per Woodside's internal auditing process.

Audit, inspection and review findings relevant to continuous improvement of environmental performance are tracked through the Environmental Commitments and Actions Register (eCAR). This eCAR is used to track project vessel compliance with EP commitments, including any findings and corrective actions.

Non-conformances identified will be reported and/or tracked in accordance with Section 7.5.4.

7.5.3 Marine Assurance

Woodside’s marine assurance process is managed by the Marine Assurance Team of the Marine Services Group. The Woodside process is based on industry standards and consideration of guidelines and recommendations from recognised industry organisations such as Oil Companies International Marine Forum and International Maritime Contractors Association.

The process is mandatory for all vessels hired for Woodside operations, including for short term hires (i.e. <3 months in duration). It defines applicable marine offshore assurance activities, ensuring that all vessel operators operate seaworthy vessels that meet the requirements for a defined scope of work and are managed with a robust safety management system.

The process is multi-faceted and encompasses the following marine assurance activities:

- Offshore Vessel Safety Management System Assessment (OVMSA)
- OVID
- project support for tender review, evaluation, pre/post contract award.

OVID inspections are objective in nature and reflect what was observed by the Inspector while conducting the inspection. The inspection provides observations as opposed to non-conformities.

Where an OVID inspection and/or OVMSA Verification Review is not available and all reasonable efforts based on time and resource availability to complete an OVID inspection and/or OVMSA Verification Review are performed (i.e. short term vessel hire), the Marine Assurance Specialist Offshore may approve the use of an alternate means of inspection, known as a risk assessment.

7.5.3.1 Risk Assessment

Woodside conducts a risk assessment of vessels where either an OVMSA Verification Review and/or an OVID inspection cannot be completed. This is not a regular occurrence and is typically used when the requirements of the assurance process are unable to be met or the processes detailed are not applicable to a proposed vessel(s).

The risk assessment is a semi-quantitative method of determining what further assurance process activity, if any, is required to assure a vessel for a particular task or role. The process compares the level of management control a vessel is subject to, against the risk factors associated with the activity or role.

Several factors are assessed as part of a vessel risk assessment, including:

- management control factors:
  - Company audit score (i.e. management system)
  - vessel HSE incidents
  - vessel Port State Control deficiencies
  - instances of Port State Control vessel detainment
  - years since previous satisfactory vessel inspection
  - age of vessel
  - contractors’ prior experience operating for Woodside.
- activity risk factors:
  - people health and safety risks (a function of the nature of the work and the area of operation)
  - environmental risks (a function of environmental sensitivity, activity type and magnitude of potential environment damage (e.g. largest credible oil spill scenario)

- value risk (likely time and cost consequence to Woodside if the vessel becomes unusable)
- reputation risk
- exposure (i.e. exposure to risk based on duration of project)
- industrial relations risk.

The acceptability of the vessel or requirement for further vessel inspections or audits is based on the ratio of vessel score to activity risk. If the vessel management control is not deemed to appropriately manage activity risk, then a satisfactory company audit and/or vessel inspection may be required before awarding work.

The risk assessment is valid for the period a vessel is on hire and for the defined scope of work.

7.5.4 Management of Non-conformance

Woodside classifies non-conformances with environmental performance outcomes and standards in this EP as environmental incidents. Woodside employees and Contractors are required to report all environmental incidents, and these are managed as per Woodside's internal event recording, investigation and learning requirements.

An internal computerised database called First Priority is used for the recording and reporting of 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 First Priority and closed out in a timely manner.

Woodside uses a consequence matrix for classification of environmental incidents, with the significant categories being A, B and C (as detailed in Section 2.6). Detailed investigations are completed for all categories A, B, C and high potential environmental incidents.

7.5.5 Review

7.5.5.1 Management Review

Within the Environment function, senior management regularly monitors and reviews environmental performance and the effectiveness of managing environmental risks and performance. Within each Function and Business Unit Leadership Team (e.g. Drilling and Completions, Subsea and Developments/Projects), managers review environmental performance regularly, including through quarterly HSE review meetings.

7.5.5.2 Learning and Knowledge Sharing

Learning and knowledge sharing occurs via a number of different methods including:

- event investigations
- event bulletins
- after action review conducted at the end of the activity, including review of environmental incidents as relevant
- ongoing communication with vessel operators
- formal and informal industry benchmarking
- cross asset learnings
- Engineering and Technical Authorities discipline communications and sharing.

7.5.5.3 Review of Impacts, Risks and Controls Across the Life of the EP

In the unlikely case that activities described in this EP do not occur continuously or sequentially, before recommencing activities after a cessation period greater than 12 months, impacts, risks and controls will be reviewed.

The process will identify or review impacts and risks associated with the newly-commencing activity, and will identify or review controls to ensure impacts and risks remain/are reduced to ALARP and acceptable levels. Information learned from previous activities conducted under this EP will be considered. Controls which have previously been excluded on the basis of proportionality will be reconsidered. Any required changes will be managed by the Management of Change (MOC) process outlined below (Section 7.6).

7.6 Environment Plan Management of Change and Revision

Management of changes relevant to this EP concerning the scope of the activity description (Section 3), including review of advances in technology at stages where new equipment may be selected such as vessel contracting, changes in understanding of the environment, including all current advice from DoEE on species protected under EPBC Act and current requirements for Australian Marine Parks (Section 4), and potential new advice from external stakeholders (Section 7), will be managed in accordance with Regulation 17 of the Environment Regulations.

Risk will be assessed in accordance with the Environmental Risk Management Methodology (Section 2.2) to determine the significance of any potential new environmental impacts or risks not provided for in this EP. Risk assessment outcomes are reviewed in compliance with Regulation 17 of the Environment Regulations.

Minor changes where a review of the activity and the environmental risks and impacts of the activity do not trigger a requirement for a revision, under Regulation 17 of the Environment Regulations, will be considered a ‘minor revision’. Minor administrative changes to this EP, where an assessment of the environmental risks and impacts is not required (e.g. document references, phone numbers), will also be considered a ‘minor revision’. Minor revisions as defined above will be made to this EP using Woodside’s document control process. Minor revisions will be tracked in an MOC register to ensure visibility of cumulative risk changes, as well as enable internal EP updates/reissuing as required. This document will be made available to NOPSEMA during regulator environment inspections.

7.7 Record Keeping

Compliance records (outlined in Measurement Criteria in Section 6) will be maintained.

Record keeping will be in accordance with Regulation 14(7) which addresses maintaining records of emissions and discharges.

7.8 Reporting

To meet the environmental performance outcomes and standards outlined in this EP, Woodside reports at a number of levels, as outlined in the next sections.

7.8.1 Routine Reporting (Internal)

7.8.1.1 Daily Progress Reports and Meetings

Daily reports for project activities are prepared and issued to key support personnel and stakeholders, by relevant managers responsible for the project. The report provides performance information on project activities, HSE, and 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 issue resolution.

7.8.1.2 Regular HSE Meetings

Regular dedicated HSE meetings are held with the offshore and Perth-based management and advisers to address targeted HSE incidents and initiatives. Minutes of these meetings are produced and distributed as appropriate.

7.8.1.3 Performance Reporting

Monthly and quarterly performance reports are developed and reviewed by the Function and Business Unit Leadership Teams. These reports cover a number of subjects, including:

- HSE incidents (including high potential incidents and those related to this EP) and recent activities
- Corporate Key Performance Indicator targets, which include environmental metrics
- outstanding actions as a result of audits or incident investigations
- technical high and low lights.

7.8.2 Routine Reporting (External)

7.8.2.1 Start and End Notifications of the Petroleum Activities Program

In accordance with Regulation 29, Woodside will notify NOPSEMA and Department of Mines, Industry Regulation and Safety (DMIRS) of the commencement of the Petroleum Activities Program at least ten days before the activity commences and will notify NOPSEMA and DMIRS within ten days of completing the activity.

7.8.2.2 Environmental Performance Review and Reporting

In accordance with applicable environmental legislation for the activity, Woodside is required to report information on environmental performance to the appropriate regulator. Regulatory reporting requirements are summarised in Table 7-2.

Table 7-2: Routine external reporting requirements

Report	Recipient	Frequency	Content
Monthly Recordable Incident Reports (Appendix E)	NOPSEMA	Monthly, by the 15th of each month.	Details of recordable incidents that have occurred during the Petroleum Activities Program for the previous month (if applicable).
Environmental Performance Report	NOPSEMA	Annually, with the first report submitted within 12 months of commencing the Petroleum Activities Program covered by this EP, as per the requirements of Regulation 14(2).	Compliance with environmental performance outcomes, controls and standards outlined in this EP, in accordance with the Environment Regulations.

7.8.2.3 End of the Environment Plan

The EP will end when Woodside notifies NOPSEMA that the Petroleum Activities Program has ended and all of the obligations identified in this EP have been fulfilled, and NOPSEMA has accepted the notification, in accordance with Regulation 25A of the Environment Regulations.

7.8.3 Incident Reporting (Internal)

Woodside has a defined process for the internal reporting of incidents. It is the responsibility of the Woodside Project Manager to ensure that reporting of environmental incidents meets the internal reporting requirements as defined in the Woodside HSE event notification matrix.

7.8.4 Incident Reporting (External) – Reportable and Recordable

7.8.4.1 Reportable Incidents

Definition

A reportable incident is defined under Regulation 4 of the Environment Regulations as:

- *'an incident relating to the activity that has caused, or has the potential to cause, moderate to significa*nt environmental damage'.

A reportable incident for the Petroleum Activities Program is:

- an incident that has caused environmental damage with a Consequence Level of Moderate (C) or above, as defined under Woodside's Risk Table (refer to Figure 2-6)
- an incident that has the potential to cause environmental damage with a Consequence Level of Moderate (C) or above, as defined under Woodside's Risk Table (refer to Figure 2-6).

No impacts or risk were identified that have the potential to cause a consequence level of Moderate (C) for the Petroleum Activities Program (Section 6).

Any such incidents represent potential events which would be reportable incidents. Incidents are reporting with consideration of NOPSEMA (2014) guidance stating, 'if in doubt, notify NOPSEMA', and assessed case-by-case to determine if they trigger a reportable incident as defined in this EP and by the Regulations.

Notification

NOPSEMA will be notified of all reportable incidents, according to the requirements of Regulations 26, 26A and 26AA of the Environment Regulations. Woodside will:

- report all reportable incidents to the regulator (orally) as soon as practicable, but within two hours of the incident or of its detection by Woodside
- provide a written record of the reported incident to NOPSEMA, the National Offshore Petroleum Titles Administrator and the Department of the responsible State Minister (DMIRS) as soon as practicable after the oral reporting of the incident
- complete a written report for all reportable incidents using a format consistent with the NOPSEMA Form FM0831 – Reportable Environmental Incident which must be submitted to NOPSEMA as soon as practicable, but within three days of the incident or of its detection by Woodside
- provide a copy of the written report to the National Offshore Petroleum Titles Administrator and DMIRS, within seven days of the written report being provided to NOPSEMA.

AMSA will be notified of oil spill incidents as soon as practicable following their occurrence, and DoEE if MNES are to be affected by the oil spill incident.

7.8.4.2 Recordable Incidents

Definition

A recordable incident is defined under Regulation 4 of the Environment Regulations as an incident arising from the activity that:

- 'breaches an environmental performance outcome or environmental performance standard, in the EP that applies to the activity, that is not a reportable incident'.

Notification

NOPSEMA will be notified of all recordable incidents, according to the requirements of Regulation 26B(4), not later than 15 days after the end of the calendar month using the NOPSEMA Form – Recordable Environmental Incident Monthly Summary Report (Appendix E) detailing:

- a record of all recordable incidents that occurred during the calendar month
- 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 is proposed to be taken, to prevent similar recordable incidents
- the action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future.

7.8.4.3 Other External Incident Reporting Requirements

In addition to the notification and reporting of environmental incidents defined under the Environment Regulations and Woodside requirements, Table 7-3 describes the incident reporting requirements that also apply in the Permit Area.

Table 7-3: External incident reporting requirements

Incident	Responsible	Notifiable party	Notification Requirements	Contact	Contact Details
Any marine incidents during Petroleum Activities Program, as per AMSA requirements	Vessel Master	AMSA	Incident Alert Form 18 as soon as reasonably practicable* Within 72 hours after becoming aware of the incident, submit Incident Report Form 19	AMSA	reports@amsa.gov.au
Oil pollution incidents in Commonwealth waters	Vessel Master	AMSA JRCC	As per Article 8 and Protocol I of MARPOL within two hours via the national emergency 24-hour notification contacts and a written report within 24 hours of the request by AMSA	AMSA JRCC	If the ship is at sea, reports are to be made to: Free call: 1800 641 792 Phone: 08 9430 2100 (Fremantle)
Oil pollution incident in Commonwealth waters	Vessel Master	AMSA	Without delay as per *Protection of the Sea Act*, part II, section 11(1), verbally notify AMSA RCC via the national emergency 24-hour notification contact of the hydrocarbon spill Follow up with a written Pollution Report as soon as practicable following verbal notification	JRCC Australia	Phone: 1800 641 792 or +61 2 6230 6811 AFTN: YSARYCYX
Any oil pollution incident which has the potential to enter a National Park or requires oil spill response activities to be conducted within a National Park	Woodside	Department of Environment and Energy	Reported verbally, as soon as practicable	Director of National Parks	Phone: 02 6274 2220
Activity causes unintentional death of or injury to fauna species listed as Threatened or Migratory under the EPBC Act	Woodside	Department of Environment and Energy	Within seven days of becoming aware	Secretary of the DoEE	Phone: 1800 803 772 Email: protected.species@environment.gov.au

Additionally, the following pollution activity should also be reported to AMSA via JRCC by the Vessel Master:

- any loss of plastic material
- garbage disposed of in the sea within 12 nm of land (garbage includes food, paper, bottles, etc.)
- any loss of hazardous materials.

For oil spill incidents, other agencies and organisations will be notified as appropriate to the nature and scale of the incident as per procedures and contact lists in the Oil Pollution Emergency Arrangements (Australia) and the WA-49-L Gemtree Anchor Hold Testing Pollution First Strike Plan.

External incident reporting requirements required under the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations including under sub regulation 2.42, notices and reports of dangerous occurrences will be reported to NOPSEMA under the approved activity safety cases.

7.9 Emergency Preparedness and Response

7.9.1 Overview

Under Regulation 14(8), the implementation strategy must contain an OPEP and provide for updating the OPEP. Regulation 14(8AA) outlines the requirements for the OPEP which must include adequate arrangements for responding to and monitoring oil pollution.

A summary of how this EP and supporting documents address the various requirements of Environment Regulations relating to oil pollution response arrangements is shown in Table 7-4.

Table 7-4: Oil pollution and preparedness and response overview

Content	Environment Regulations Reference	Document/Section Reference
Details of (oil pollution response) control measures that will be used to reduce the impacts and risks of the activity to ALARP and an acceptable level	Regulation 13(5), (6), 14(3)	Oil Spill Preparedness and Response Mitigation Assessment for WA-49-L Gemtree Anchor Hold Testing EP (Appendix D)
Description of the OPEP	Regulation 14(8)	Environment Plan: Woodside's OPEP has the following components: • Woodside Oil Pollution Emergency Arrangements (Australia) • WA-49-L Gemtree Anchor Hold Testing EP Oil Pollution First Strike Plan • Oil Spill Preparedness and Response Mitigation Assessment for WA-49-L Gemtree Anchor Hold Testing EP (Appendix D).
Details of the arrangements for responding to and monitoring oil pollution (to inform response activities), including control measures	Regulation 14(8AA)	Oil Spill Preparedness and Response Mitigation Assessment for WA-49-L Gemtree Anchor Hold Testing EP (Appendix D) WA-49-L Gemtree Anchor Hold Testing Oil Pollution First Strike Plan
Details of the arrangements for updating and testing the oil pollution response arrangements	Regulation 14(8), (8A), (8B), (8C)	WA-49-L Gemtree Anchor Hold Testing EP: Section 7.9.3 Oil Spill Preparedness and Response Mitigation Assessment for WA-49-L Gemtree Anchor Hold Testing EP (Appendix D)
Details of provision, monitoring impacts to the environment from oil pollution and response activities	Regulation 14(8D)	Oil Spill Preparedness and Response Mitigation Assessment for WA-49-L Gemtree Anchor Hold Testing EP (Appendix D)
Demonstration that the oil pollution response arrangements are consistent with the national system for oil pollution preparedness and control	Regulation 14(8E)	Woodside's Oil Pollution Emergency Arrangements (Australia)

7.9.2 Emergency Response Preparation

The Corporate Incident Coordination Centre (CICC), based in Woodside's head office in Perth, is the onshore coordination point for an offshore emergency. The CICC is staffed by a roster of appropriately skilled personnel available on call 24 hours a day. The CICC, under the leadership of the CICC Duty Manager, supports the site-based Incident Management Team (IMT) by providing, operations, logistics, planning, people management and public information (corporate affairs) support. A description of Woodside's Incident Command Structure and arrangements is further detailed in the Woodside Oil Pollution Emergency Arrangements (Australia).

An Emergency Response Plan (ERP) will be drafted for the Petroleum Activities Program covered by this EP. The ERP will contain instructions for vessel emergency, medical emergency, search and rescue, reportable incidents, incident notification, contact information and activation of the Contractor's emergency centre and Woodside Communication Centre (WCC).

In the event of an emergency of any type, the Vessel Master will assume overall onsite command and act as the Incident Controller (IC). All persons will be required to act under the IC's directions. The vessels will maintain communications with the onshore project manager and/or other emergency services in the event of an emergency. Emergency response support can be provided by the Contractor's emergency centre or WCC if requested by the IC.

7.9.3 Oil and Other Hazardous Materials Spill

A significant hydrocarbon spill during the proposed Petroleum Activities Program is unlikely, but should such an event occur, it has the potential to cause a serious safety incident, environmental, asset and reputational damage if not managed properly. The Woodside Oil Pollution Emergency Arrangements (Australia) document, supported by the WA-49-L Gemtree Anchor Hold Testing – Oil Pollution First Strike Plan which provides tactical response guidance to the activity/area and Appendix D of this EP, cover spill response for this Petroleum Activities Program.

The Oil Spill Preparedness Manager is responsible for managing Woodside's oil spill response equipment, and for maintaining oil spill preparedness and response documentation. In the event of a major spill, Woodside will request that AMSA (administrator of the National Plan) provides support to Woodside through advice and access to equipment, people and liaison. The interface and responsibilities, as defined under the National Plan, are described in the Woodside Oil Pollution Emergency Arrangements (Australia). AMSA and Woodside have an Memorandum of Understanding (MoU) in place to support Woodside in the event of an oil spill.

WA-49-L Gemtree Anchor Hold Testing – Oil Pollution First Strike Plan provides immediate actions required to commence a response.

The project vessels will have SOPEPs in accordance with the requirements of MARPOL 73/78 Annex I. These plans outline responsibilities, specify procedures and identify resources available in the event of a hydrocarbon or chemical spill from vessel activities. The Oil Pollution First Strike Plan is intended to work in conjunction with the SOPEPs, if hydrocarbons are released to the marine environment from a vessel.

Woodside has established environmental performance outcomes, performance standards and measurement criteria to be used for oil spill response during the Petroleum Activities Program, as detailed in Appendix D.

7.9.4 Emergency and Spill Response

Woodside categorises incidents and emergencies in relation to response requirements as follows:

Level 1

Level 1 incidents are those that can be resolved using existing resources, equipment and personnel. A Level 1 incident is contained, controlled and resolved by site/regionally based teams using existing resources and functional support services.

Level 2

Level 2 incidents are characterised by a response that requires external operational support to manage the incident. It is triggered if the capabilities of the tactical level response are exceeded. This support is provided to the activity via the activation of all, or part of, the responsible ICC.

Level 3

A Level 3 incident or crisis is identified as a critical event that seriously threatens the organisation's people, the environment, company assets, reputation, livelihood or essential services. At Woodside, the Crisis Management Team (CMT) manages the strategic impacts in order to respond to and recover from the threat to the Company (material impacts, litigation, legal & commercial, reputation, etc.). The ICC may also be activated as required to manage the operational response to the Level 3 Incident.

7.9.5 Emergency and Spill Response Drills and Exercises

Testing of Woodside's capability to respond to incidents will be conducted in alignment with the Woodside Emergency and Crisis Management Procedure. The frequency of these tests will be conducted as prescribed in Table 7-5.

The company emergency response testing regime is aligned to existing or developing risks associated with Woodside's operations and activities. Corporate hazards/risks outlined in the corporate risk register, respective Safety Cases or project Risk Registers, are the key reference point for EM and CM exercise development. External participants may be invited to attend crisis exercises and may include government agencies, specialist service providers, oil spill response organisations or industry members with which we have mutual aid arrangements.

The objective is to exercise procedures, skills and teamwork of the Emergency Response and Command Teams in their ability to respond to Major Accident Events (MAE) and Major Environment Events (MEE). After each exercise, the team holds a debrief session, during which the exercise is reviewed. Any lessons learnt or areas for improvement are identified and incorporated into emergency procedures where appropriate.

Table 7-5: Testing of response capability to incidents

Incident Type	Response Testing
Level 1 Response	One oil spill response exercise to be conducted during the activity. This drill should test elements of the recommended response identified in the WA-49-L Gemtree Anchor Hold Test – Oil Pollution First Strike Plan in relation to the level of the incident.
	One Level one emergency drill to be conducted per week, during the activity.

7.9.5.1 Testing of Oil Spill Response Arrangements

There are a number of arrangements which in the event of a spill will underpin Woodside's ability to implement a response across its petroleum activities. In order to ensure each of these arrangements is adequately tested, the Hydrocarbon Spill Preparedness Capability and Competency Coordinator ensures tests are conducted in alignment with Woodside's testing schedule.

Woodside's Hydrocarbon Spill Preparedness & Response testing schedule aligns with international good practice for spill preparedness and response management. The testing is compatible with the IPIECA Good Practice Guide and the Australian Emergency Management Institute Handbook.

The schedule identifies the type of test which will be conducted annually for each arrangement, and how this type will vary over a five year rolling schedule. Testing methods may include (but are not limited to) audits, drills, field exercises, functional workshops, assurance reporting, assurance monitoring and reviews of key external dependencies.

Activity-specific Oil Spill Pollution First Strike Plans are developed to meet the response needs of that particular activity's Worst Credible Spill Scenario (WCCS). The ability to implement these plans may rely on specific arrangements or those common to other Woodside activities. Regardless of their commonality, each arrangement will be tested in at least one of the methods annually. The activity-specific Hydrocarbon Pollution First Strike Plan will be tested in alignment with Table 7-5.

This ensures personnel are familiar with spill response procedures, reporting requirements and roles/responsibilities.

At the completion of testing, a report is produced to demonstrate the outcomes achieved against the tested objectives. The report will include the lessons learned, any improvement actions and a list of the participants. Alternatively an assurance report, assurance records or audit report may be produced. These reports record findings and include any recommendations for improvement. Improvement actions and their close-out are actively recorded and managed.

7.9.6 Cyclone and Dangerous Weather Preparation

The timing of the activity associated with the Petroleum Activities Program is not yet determined, however it is possible project activities will overlap with the cyclone season (November to April, with most cyclones occurring between January and March). If the activity is to occur in cyclone season, the vessel contractors must have a Cyclone Contingency Plan (CCP) in place outlining the processes and procedures that would be implemented during a cyclone event, which will be reviewed and accepted by Woodside.

The project vessels will receive daily forecasts from the BoM. If a cyclone (or severe weather event) is forecast, the path and its development will be plotted and monitored using the BoM data. If there is the potential for the cyclone (severe weather event) to affect the Petroleum Activities Program, the CCP will be actioned. If required, vessels can transit from the proposed track of the cyclone (severe weather event).

7.10 Implementation Strategy and Reporting Commitments Summary

Table 7-6 summarises key components within the implementation strategy.

Table 7-6: Implementation strategy and reporting commitments summary

Implementation Strategy (IS) Performance Outcome	Implementation Strategy Performance Standard	Implementation Strategy Measurement Criteria
PO IS-1 All crew will be aware of their roles and responsibilities regarding environmental risks throughout the Petroleum Activities Program.	**PS IS-1.1** All personnel are required to attend an induction before commencing work. These inductions cover health, safety and environmental requirements for project vessels, and environmental information specific to the Petroleum Activities Program location.	**MC IS-1.1.1** Induction attendance records.
	PS IS-1.2 A pre-activity meeting will be held on the AHV with relevant personnel before conducting the Petroleum Activities Program, focusing on any specific environmental sensitivities associated with the activity.	**MC IS-1.1.2** Pre-activity meeting attendance records and minutes.
	PS IS-1.3 During operations, regular HSE meetings will be held on the project vessels which cover all crew. Recent environmental incidents will be reviewed and awareness material presented regularly.	**MC IS-1.3.1** Attendance is recorded and lists retained on the project vessels.
	PS IS-1.4 The vessel contractors must have a CCP accepted by Woodside, outlining the processes and procedures that would be implemented during a cyclone event, if the anchor hold test is to take place during cyclone season.	**MC IS-1.4.1** Record of Woodside-approved Contractor CCP in place prior to activities commencing.
PO IS-2 Woodside and its Contractors will perform a program of periodic monitoring during the Petroleum Activities Program – starting at	**PS IS-2.1** Monitoring information will be collected using Woodside tools and systems	**MC-IS 2.1.1** Monitoring reports including daily reports, periodic reports, risk observation cards, environmental discharge reports

Implementation Strategy (IS) Performance Outcome	Implementation Strategy Performance Standard	Implementation Strategy Measurement Criteria
mobilisation and continuing through the duration of the activity to completion.	**PS IS-2.2** Periodic review of the Woodside Environmental Knowledge Management System to maintain currency of receptor knowledge.	**MC-IS 2.2.1** Review records Corporate Environment Baseline Database
PO IS-3 Woodside will audit environmental performance.	**PS IS-3.1** A Vessel based HSE inspection will be conducted by vessel personnel.	**MC IS-3.1.1** Completed HSE inspection checklists.
	PS IS-3.2 Audit findings relevant to continuous improvement of environmental performance will be tracked on a register.	**MC IS-3.2.1** Records demonstrate tracking of audit findings.
	PS IS-3.3 Marine assurance will be undertaken in accordance with Woodside's internal assurance process and is mandatory for all vessels hired for Woodside.	**MC IS-3.3.1** Records demonstrate marine assurance reviews conducted as required.
PO IS-4 Woodside employees and Contractors will report all environmental incidents and non-conformance with environmental performance outcomes and standards in this EP.	**PS IS-4.1** Non-conformances to be notified, investigated and reported in accordance with Woodside's event recording, investigation and learnings requirements.	**PS IS-4.1.1** Records demonstrate Non-conformances are notified, investigated and reported in accordance with Woodside's event recording, investigation and learnings requirements.
PO IS-5 Woodside will perform regular reviews to monitor environmental performance and share knowledge and learning.	**PS IS-5.1** Woodside is to hold quarterly HSE Review meetings.	**PS IS-5.1.1** Records demonstrate meetings reviewed HSE performance.
	PS IS-5.2 After action review conducted at the end of each activity for learning and knowledge sharing, including review of environmental incidents as relevant.	**PS IS-5.2.1** After action review report
PO IS-6 Changes in activity scope, understanding of the environment and potential new advice from external stakeholders will be tracked and the EP updated as required.	**PS IS-6.1** Management of change relevant to this EP to be managed in accordance with Regulation 17 of the Environment Regulations	**PS IS-6.1.1** Records of minor revisions to the EP tracked in an MOC Register. Revision and resubmission of the EP as required.
PO IS-7 All internal and external reporting requirements relevant to this EP will be met.	**PS IS-7.1** Regular HSE meetings Monthly and quarterly HSE performance reports	**MC IS-7.1.1** HSE performance reports. Minutes of HSE meetings
	PS IS-7.2 Woodside will submit an environmental performance report to NOPSEMA (annually, with the first report submitted within 12 months of commencing the activity) .	**MC IS-7.2.1** Record of submission of environmental performance reports to NOPSEMA.

Implementation Strategy (IS) Performance Outcome	Implementation Strategy Performance Standard	Implementation Strategy Measurement Criteria
	PS IS-7.3 Woodside will submit a monthly recordable incident report to NOPSEMA.	**MC IS-7.3.1** Record of submission of monthly recordable incident report to NOPSEMA.
PO IS-8 All external notification requirements, as applicable to this EP, will be met.	**PS IS-8.1** Woodside will notify NOPSEMA and DMIRS of the commencement of the Petroleum Activities Program at least ten days before the activity commences. Woodside will notify NOPSEMA and DMIRS within ten days of completing the activity.	**MC IS-8.1.1** Record of notification to NOPSEMA. Record of notification to DMIRS.
	PS IS-8.2 The EP will end when Woodside notifies NOPSEMA that the Petroleum Activities Program has ended and all of the obligations identified in this EP have been completed, and NOPSEMA has accepted the notification, in accordance with Regulation 25A.	**MC IS-8.2.1** Record of notification to NOPSEMA.
	PS IS-8.3 NOPSEMA will be notified of all reportable incidents, according to the requirements of Regulations 26, 26A and 26AA of the Environment Regulations.	**MC IS-8.3.1** Record of notifications to NOPSEMA
	PS IS-8.4 DoEE (if MNES affected) will be notified of oil spill incidents as soon as practicable following the occurrence.	**MC IS-8.4.1** Record of notification to DoEE if MNES is affected.
	PS IS-8.5 DPIRD (formerly DoF) and peak fishing bodies will be notified prior to and upon completing the proposed activity, including vessel details.	**MC IS-8.5.1** Records of notification to the Department and peak fishing bodies.
	PS IS-8.6 Any oil pollution incidents in Commonwealth waters will be reported without delay (by the vessel master) to AMSA JRCC as per the *Protection of the Sea (Prevention of Pollution from Ships) Act*, Part II, Section 11(1). The verbal report shall be made via the national emergency 24-hour notification contact, and if AMSA requests a written report, it should be provided within 24 hours of the request.	**MC IS 8.6.1** Records of notification to AMSA.
PO IS-9 Planned and unplanned emissions and discharges will be documented and records maintained.	**PS IS-9.1** The volumes of planned and unplanned emissions and discharges that could result from the risks described in **Section 6.6 and 6.7** are documented in the daily reports.	**MC IS-9.1.1** Records of planned and unplanned emissions and discharges are maintained in daily reports.

Implementation Strategy (IS) Performance Outcome	Implementation Strategy Performance Standard	Implementation Strategy Measurement Criteria
PO IS-10 Personnel holding responsibilities in a response will test the arrangements supporting the activities OPEP to ensure they are effective and communicated.	PS IS-10.1 Exercises will be conducted in alignment with the frequency identified in Table 7-5. These arrangements are conducted in accordance with Regulation 14(8B) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009. • Arrangements are tested when introduced. • Arrangements are tested in accordance with Woodside's Hydrocarbon Spill Arrangements Testing Schedule as per the frequency identified in Table 7-5. • Arrangements will be tested when the OPEP is significantly amended, and further testing will occur if a new activity location is added to the EP.	**MC IS-10.1.1** Spill response exercise reports and key participants maintained in the Woodside IMS system. Records managed in Hydrocarbon Spill Preparedness Unit (HSPU) Testing of Arrangements Register.
	PS IS-10.2 Post exercise reports will be developed for each exercise to measure performance against the objectives, and the learnings from the plan updated in the OPEP following these learnings.	**MC IS-10.2.1** Spill response exercise reports and key participants maintained in the Woodside IMS system. Records managed in HSPU Testing of Arrangements Register.
	PS IS-10.3 Close-out of HSPU actions from exercising are managed in the HSPU Testing of Arrangements Register.	**MC IS-10.3.1** Records managed in HSPU Testing of Arrangements Register.
PO IS-11 Woodside will ensure that the arrangements supporting the activities OPEP are validated.	**PS IS-11.1** Activity OPEPs will be revised at a minimum every five years.	**MC IS-11.1.1** OPEP current and available.
PO IS-12 The OPEP will only be updated under specific circumstances to ensure the information is current.	**PS IS-12.1** Relevant documents from the OPEP will be reviewed when: • implementing an improved preparedness measure • the availability of equipment stockpiles changes • the availability of personnel changes that reduces or improves preparedness and the capacity to respond • a new or improved technology is introduced that may be considered in a response for this activity • incorporating, where relevant, lessons learned from exercises or events • national or state response frameworks and Woodside's integration with these frameworks changes.	**MC IS-12.1.1** The following records will be maintained: • Woodside's HSPU Testing of arrangements register • Woodside's Internal Equipment Maintenance Register • OPEP current and available.

Implementation Strategy (IS) Performance Outcome	Implementation Strategy Performance Standard	Implementation Strategy Measurement Criteria
PO IS-13 Woodside will perform a vessel risk assessment where an OVID inspection and/or OVMSA Verification Review is not available (i.e. short term vessel hire).	**PS IS-13.1** The Marine Vessel Risk Assessment will be conducted by the Marine Assurance Superintendent, or the nominated deputy, where the vessel meets the short term hire prerequisites.	**MC IS-13.1.1** Marine Vessel Risk Assessment sheet demonstrates the assessment has been conducted.

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8.1 Glossary and Acronyms

Term	Meaning
(the) Regulator	The Government Agency (State or Commonwealth) that is the decision maker for approvals and undertakes ongoing regulation of the approval once granted.
Acceptability	The EP must demonstrate that the environmental impacts and risks of an activity will be of an acceptable level as per Regulation 10A(c).
ALARP	A legal term in Australian safety legislation, it is taken here to mean that all contributory elements and stakeholdings have been considered by assessing costs and benefits, and which identifies a preferred course of action.
Ballast	Extra weight taken on to increase a ship's stability to prevent rolling and pitching. Most ships use seawater as ballast. Empty tank space is filled with inert (non-combustible) gas to prevent the possibility of fire or explosion.
Bathymetry	Related to water depth – a bathymetry map shows the depth of water at a given location on the map.
Benthos/Benthic	Relating to the seabed, and includes organisms living in or on sediments/rocks on the seabed.
Biodiversity	Relates to the level of biological diversity of the environment. The EPBC Act defines biodiversity as: "the variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part) and includes: (a) diversity within species and between species; and (b) diversity of ecosystems".
Biota	The animal and plant life of a particular region, habitat or geological period.
Cetacean	Whale and dolphin species.
Consequence	The worst-case credible outcome associated with the selected event, assuming some controls (prevention and mitigation) have failed. Where more than one impact applies (e.g. environmental and legal/compliance), the consequence level for the highest severity impact is selected.
Coral	Anthozoa that are characterised by stone-like, horny or leathery skeletons (external or internal). The skeletons of these animals are also called coral.
Coral Reef	A wave-resistant structure resulting from skeletal deposition and cementation of hermatypic corals, calcareous algae, and other calcium carbonate-secreting organisms.
Crustacean	A large and variable group of mostly aquatic invertebrates which have a hard external skeleton (shell), segmented bodies, with a pair of often very modified appendages on each segment, and two pairs of antennae (e.g. crabs, crayfish, shrimps, wood lice, water fleas and barnacles).
Cyclone	A rapidly-rotating storm system characterised by a low-pressure centre, strong winds, and a spiral arrangement of thunderstorms that produce heavy rain.
Datum	A reference location or elevation which is used as a starting point for subsequent measurements.
dB	Decibel – a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (that is, 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
dB re 1 μPa^2	Measure of underwater noise, in terms of sound pressure. Because the dB is a relative measure, rather than an absolute measure, it must be referenced to a standard "reference intensity", in this case 1 micro Pascal (1 mPa), which is the standard reference that is used. The dB is also measured over a specified frequency, which is usually either a one Hertz bandwidth (expressed as dB re 1 m Pa^2/Hertz (Hz)), or over a broadband which has not been filtered. Where a frequency is not specified, it can be assumed that the measurement is a broadband measurement.
dB re 1 $\mu Pa^2.s$	Normal unit for sound exposure level.
Demersal	Living close to the floor of the sea (typically of fish).

Term	Meaning
DRIMS	Woodside's internal document management system.
Dynamic positioning	In reference to a marine vessel that uses satellite navigation and radio transponders in conjunction with thrusters to maintain its position.
Echinoderms	Any of numerous radially symmetrical marine invertebrates of the phylum *Echinodermata*, which includes starfishes, sea urchins and sea cucumbers, which have an internal calcareous skeleton and are often covered with spines.
Endemic	A species that is native to or confined to a certain region.
Environment	The surroundings in which an organisation operates, including air, water, land, natural resources, flora, fauna, humans and their interrelations (Source: ISO 14001).
Environment Plan	Prepared in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009, which must be assessed and accepted by the Designated Authority (NOPSEMA) before any petroleum-related activity can be conducted.
Environment Regulations	OPGGS (Environment) Regulation 2009.
Environmental approval	The action of approving something, which has the potential to adversely impact the environment. Environmental impact assessment is generally required before environmental approval is granted.
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services (Source: HB 203:2006).
Environmental impact assessment	An orderly and systematic process for evaluating a proposal or scheme (including its alternatives), and its effects on the environment, and mitigation and management of those effects (Source: Western Australian *Environmental Impact Assessment Administrative Procedures 2010*).
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth legislation designed to promote the conservation of biodiversity and protection of the environment.
Epifauna	Benthic animals that live on the surface of a substrate.
Fauna	Collectively, the animal life of a particular region.
Flora	Collectively the plant life of a particular region.
Infauna	Aquatic animals that live in the substrate of a body of water, especially in a soft sea bottom.
ISO 14001	ISO 14001 is an international standard that specifies a process (called an Environmental Management System or EMS) for controlling and improving a company's environmental performance. An EMS provides a framework for managing environmental responsibilities so they become more efficient and more integrated into overall business operations.
Jig fishing	Fishing with a jig, which is a type of fishing lure. A jig consists of a lead sinker with a hook moulded into it and usually covered by a soft body to attract fish.
Likelihood	The description that best fits the chance of the selected consequence actually occurring, assuming reasonable effectiveness of the prevention and mitigation controls.
MARPOL (73/78)	The International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978. MARPOL 73/78 is one of the most important international marine environmental conventions. It was designed to minimise pollution of the seas, including dumping, oil and exhaust pollution. Its stated object is to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimisation of accidental discharge of such substances.
Meteorology	The study of the physics, chemistry and dynamics of the earth's atmosphere, including the related effects at the air–earth boundary over both land and the oceans.
Mitigation	Management measures which minimise and manage undesirable consequences.

Term	Meaning
Protected Species	Threatened, vulnerable or endangered species which are protected from extinction by preventive measures. Often governed by special Federal or State laws.
Putrescible	Refers to food scraps and other organic waste associated with food preparation that will be subject to decay and rot (putrefaction).
Risk	The combination of the consequences of an event and its associated likelihood. For guidance see Environmental Guidance on Application of Risk Management Procedure.
Sessile	Organism that is fixed in one place: immobile.
Teleost	A fish belonging to the Teleostei or Teleostomi, a large group of fishes with bony skeletons, including most common fishes. The teleosts are distinct from the cartilaginous fishes such as sharks, rays and skates.
Thermocline	A temperature gradient in a thermally stratified body of water.
Zooplankton	Plankton consisting of small animals and the immature stages of larger animals.

Abbreviation	Meaning
μm	Micrometer
AFMA	Australian Fisheries Management Authority
AHS	Australian Hydrographic Service
AHV	Anchor Handling Vessel
AIMS	Australian Institute of Marine Science
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
AS/NZS	Australian/New Zealand Standard
ATSB	Australian Transport Safety Bureau
AusSAR	Australian Search and Rescue
BIA	Biologically Important Area
BoM	Bureau of Meteorology
BRUVS	Baited Remote Underwater Video System
CALM	Department of Conservation and Land Management
CCP	Cyclone Contingency Plan
CICC	Corporate Incident Communication Centre
CS	Cost/Sacrifice
CV	Company Values
DAA	Department of Aboriginal Affairs
DAFF	Department of Agriculture, Fisheries and Forestry
DEC	Department of Environment and Conservation
DEH	Department of Environment and Heritage
DEWHA	Department of the Environment, Water, Heritage and the Arts
DMIRS	Department of Mines, Industry Regulation and Safety
DNP	Director of National Parks
DoEE	Department of the Environment and Energy
DoF	Department of Fisheries
DP	Dynamic Positioning
DPIRD	Department of Primary Industries and Regional Development
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
eCAR	Environmental Commitments and Actions Register
ECD	Ecologically Sustainable Development
EEZ	Exclusive Economic Zone
EMBA	Environment That May Be Affected
EMS	Environmental Management System
ENVID	Environmental Hazard Identification
EP	Environment Plan

Abbreviation	Meaning
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPO	Environmental Performance Outcome
ERP	Emergency Response Plan
F	Feasibility
GP	Good Practice
g/m²	Grams per square metre
HAZID	Hazard Identification
HSE	Health, Safety and Environment
HSPU	Hydrocarbon Spill Preparedness Unit
Hz	Hertz
IC	Incident Controller
IMO	International Maritime Organization
IMS	Invasive Marine Species
IMT	Incident Management Team
IPIECA	International Petroleum Industry Environmental Conservation Association
ISO	International Standards Organization
ITF	Indonesian Throughflow
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
JRCC	Joint Rescue Coordination Centre
JSA	Job Safety Analysis
KEF	Key Ecological Feature
kHz	Kilohertz
km	Kilometre
LCS	Legislation, Codes and Standards
LNG	Liquefied Natural Gas
MAF	Marine Aquarium Fishery
MC	Measurement Criteria
MDO	Marine Diesel Oil
MFO	Marine Fauna Observer
MMSI	Maritime Mobile Service Identity
MNES	Matters of National Environmental Significance
MOC	Management of Change
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
MPRA	Marine Parks and Reserves Authority
MSIN	Maritime Safety Information Notifications
NERA	National Energy Resources Australia
NIMS	Non-indigenous Marine Species

Abbreviation	Meaning
nm	Nautical mile (1852 m) a unit of distance on the sea
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NTM	Notice to Mariners
NWMR	North West Marine Region
NWS	North West Shelf
NWSTF	North West Slope Trawl Fishery
OIW	Oil in Water
OPEP	Oil Pollution Emergency Plan
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 1999*
OVID	Offshore Vessel Inspection Database
OVMSA	Offshore Vessel Safety Management System Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PJ	Professional Judgement
ppb	Parts per Billion
ppm	Parts per Million
PS	Performance Standard
PSU	Practical Salinity Unit
PTW	Permit to Work
RBA	Risk Based Analysis
rms	Root Mean Square
ROV	Remotely Operated Vehicle
SEL	Sound Exposure Level
SIMAP	Spill Impact Mapping and Analysis Program
SIMOPS	Simultaneous Operations
SMPEP	Spill Monitoring Programme Execution Plan
SOPEP	Ship Oil Pollution Emergency Plan
SPL	Sound Pressure Level
SV	Societal Values
US	United States of America
USBL	Ultra-Short Baseline
WA	Western Australia
WCC	Woodside Communication Centre
WSTF	Western Skipjack Tuna Fishery
WMS	Woodside Management System
Woodside	Woodside Energy Julimar Pty Ltd

APPENDIX A: WOODSIDE ENVIRONMENT & RISK MANAGEMENT POLICIES

WOODSIDE POLICY

Woodside

Risk Management Policy

OBJECTIVES

Woodside recognises that risk is inherent to its business and that effective management of risk is vital to delivering on our objectives, our success and our continued growth. We are committed to managing all risk in a proactive and effective manner.

Our approach to risk enhances opportunities, reduces threats and sustains Woodside's competitive advantage.

The objective of our risk management system is to provide a consistent process for the recognition and management of risks across Woodside's business. The success of our risk management system lies in the responsibility placed on everyone at all levels to proactively identify, manage, review and report on risks relating to the objectives they are accountable for delivering.

PRINCIPLES

Woodside achieves these objectives by:

- Applying a structured and comprehensive risk management system across Woodside which establishes common risk management understanding, language and methodology
- Identifying, assessing, monitoring and reporting risks to provide management and the Board with the assurance that risks, including contemporary and emerging risks, are being effectively identified and managed, and that Woodside is operating with due regard to the risk appetite set by the Board
- Ensuring risks consider impacts across the following key areas of exposure: health and safety, environment, finance, reputation and brand, legal and compliance, and social and cultural
- Understanding our exposure to risk and applying this to our decision making
- Embedding risk management into our critical business activities and processes
- Assuring the effectiveness of risk controls and of the risk management process
- Building our internal resilience to the effects of adverse business impacts in order to sustain performance.

APPLICATION

The Managing Director of Woodside is accountable to the Board of Directors for ensuring this policy is effectively implemented.

Managers are responsible for promoting and applying the Risk Management Policy. Responsibility for the effective application of this policy rests with all Woodside employees, contractors and joint venturers engaged in activities under Woodside operational control.

This policy will be reviewed regularly and updated as required.

Revised by the Woodside Petroleum Ltd Board on 6 December 2019.

WOODSIDE POLICY

Health, Safety, Environment and Quality Policy

OBJECTIVES

Strong health, safety, environment and quality (HSEQ) performance is essential for the success and growth of our business. Our aim is to be recognised as an industry leader in HSEQ through managing our activities in a sustainable manner with respect to our workforce, our communities and the environment.

At Woodside we believe that process and personal safety related incidents, and occupational illnesses, are preventable. We are committed to managing our activities to minimise adverse health, safety or environmental impacts, incorporating a right first time approach to quality.

PRINCIPLES

Woodside will achieve this by:

- implementing a systematic approach to HSEQ risk management
- complying with relevant laws and regulations and applying responsible standards where laws do not exist
- setting, measuring and reviewing objectives and targets that will drive continuous improvement in HSEQ performance
- embedding HSEQ considerations in our business planning and decision making processes
- integrating HSEQ requirements when designing, purchasing, constructing and modifying equipment and facilities
- maintaining a culture in which everybody is aware of their HSEQ obligations and feels empowered to speak up and intervene on HSEQ issues
- undertaking and supporting research to improve our understanding of HSEQ and using science to support impact assessments and evidence based decision making
- taking a collaborative and pro-active approach with our stakeholders
- requiring contractors to comply with our HSEQ expectations in a mutually beneficial manner
- publicly reporting on HSEQ performance

APPLICATION

Responsibility for the application of this policy rests with all Woodside employees, contractors and joint venturers engaged in activities under Woodside operational control. Woodside managers are also responsible for promotion of this policy in non-operated joint ventures.

This policy will be reviewed regularly and updated as required.

Reviewed in December 2019

APPENDIX B: RELEVANT REQUIREMENTS

This appendix refers to Commonwealth Legislation related to the Petroleum Activities Program. Western Australian State Legislation relevant to an accidental release of hydrocarbons in Western Australia State waters is outlined in the WA-49-L Anchor Hold Testing Oil Pollution Emergency Plan.

Commonwealth Legislation	Legislation Summary
Australian Maritime Safety Authority Act 1990	This Act establishes a legal framework for the Australian Maritime Safety Authority (AMSA), which represents the Australian Government and international forums in the development, implementation and enforcement of international standards including those governing ship safety and marine environment protection. AMSA is responsible for administering the Marine Orders in Commonwealth waters.
Biosecurity Act 2015 • *Quarantine Regulations 2000* • *Biosecurity Regulations 2016* Australian Ballast Water Management Requirements 2017	This Act provides the Commonwealth with powers to take measures of quarantine, and implement related programs as are necessary, to prevent the introduction of any plant, animal, organism or matter that could contain anything that could threaten Australia's native flora and fauna or natural environment. The Commonwealth's powers include powers of entry, seizure, detention and disposal. This Act includes mandatory controls on the use of seawater as ballast in ships and the declaration of sea vessels voyaging out of and into Commonwealth waters. The Regulations stipulate that all information regarding the voyage of the vessel and the ballast water is declared correctly to the quarantine officers.
Environment Protection and Biodiversity Conservation Act 1999 *Environment Protection and Biodiversity Conservation Regulations 2000*	This Act protects matters of national environmental significance (NES). It streamlines the national environmental assessment and approvals process, protects Australian biodiversity and integrates management of important natural and culturally significant places. Under this Act, actions that may be likely to have a significant impact on matters of NES must be referred to the Commonwealth Environment Minister.
Environment Protection (Sea Dumping) Act 1981 • *Environment Protection (Sea Dumping) Regulations 1983*	This Act provides for the protection of the environment by regulating dumping matter into the sea, incineration of waste at sea and placement of artificial reefs.
Industrial Chemicals (Notification and Assessment Act) 1989 • *Industrial Chemicals (Notification and Assessment) Regulations 1990*	This Act creates a national register of industrial chemicals. The Act also provides for restrictions on the use of certain chemicals which could have harmful effects on the environment or health.
National Environment Protection Measures (Implementation) Act 1998 • *National Environment Protection Measures (Implementation) Regulations 1999*	This Act and Regulations provide for the implementation of National Environment Protection Measures (NEPMs) to protect, restore and enhance the quality of the environment in Australia and ensure that the community has access to relevant and meaningful information about pollution. The National Environment Protection Council has made NEPMs relating to ambient air quality, the movement of controlled waste between states and territories, the national pollutant inventory, and used packaging materials.
National Greenhouse and Energy Reporting Act 2007 *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015*	This Act and associated Rule establishes the legislative framework for the NGER scheme for reporting greenhouse gas emissions and energy consumption and production by corporations in Australia. The requirements of this Act apply to the burning of reservoir gas during well appraisal.
Navigation Act 2012 • *Marine order 12 – Construction – subdivision and stability, machinery and electrical installations*	This Act regulates navigation and shipping including Safety of Life at Sea (SOLAS). The Act will apply to some activities of the project vessels.

Commonwealth Legislation	Legislation Summary
• *Marine order 30 - Prevention of collisions* • *Marine order 57 - Helicopter operations* • *Marine order 91 - Marine pollution prevention—oil* • *Marine order 93 - Marine pollution prevention—noxious liquid substances* • *Marine order 94 - Marine pollution prevention—packaged harmful substances* • *Marine order 96 - Marine pollution prevention—sewage* • *Marine order 97 - Marine pollution prevention—air pollution*	This Act is the primary legislation that regulates ship and seafarer safety, shipboard aspects of marine environment protection and pollution prevention.
Offshore Petroleum and Greenhouse Gas Storage Act 2006 • *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* • *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011* • *Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009*	This Act is the principal Act governing offshore petroleum exploration and production in Commonwealth waters. Specific environmental, resource management and safety obligations are set out in the Regulations listed.
Protection of the Sea (Powers of Intervention) Act 1981	This Act authorises the Commonwealth to take measures for the purpose of protecting the sea from pollution by oil and other noxious substances discharged from ships and provides legal immunity for persons acting under an AMSA direction.
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 *Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994* • *Marine order 91 - Marine pollution prevention—oil* • *Marine order 93 - Marine pollution prevention—noxious liquid substances* • *Marine order 94 - Marine pollution prevention—packaged harmful substances* • *Marine order 95 - Marine pollution prevention—garbage* • *Marine order 96 - Marine pollution prevention—sewage*	This Act relates to the protection of the sea from pollution by oil and other harmful substances discharged from ships. Under this Act, discharge of oil or other harmful substances from ships into the sea is an offence. There is also a requirement to keep records of the ships dealing with such substances. The Act applies to all Australian ships, regardless of their location. It applies to foreign ships operating between 3 nautical miles (nm) off the coast out to the end of the Australian Exclusive Economic Zone (200 nm). It also applies within the 3 nm of the coast where the State/Northern Territory does not have complementary legislation. All the Marine Orders listed, except for Marine Order 95, are enacted under both the *Navigation Act 2012* and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*. This Act is an amendment to the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*. This amended Act provides the protection of the sea from pollution by oil and other harmful substances discharged from ships.
Protection of the Sea (Harmful Antifouling Systems) Act 2006 *Marine order 98—(Marine pollution prevention—anti-fouling systems)*	This Act relates to the protection of the sea from the effects of harmful anti-fouling systems. It prohibits the application or reapplication of harmful anti-fouling compounds on Australian ships or foreign ships that are in an Australian shipping facility.
Underwater Cultural Heritage Act 2018	This Act relates to the protection and management of underwater cultural heritage in Australia, including historic shipwrecks, sunken aircraft and other underwater cultural heritage sites.

APPENDIX C: EPBC ACT PROTECTED MATTERS SEARCH

Australian Government
Department of the Environment and Energy

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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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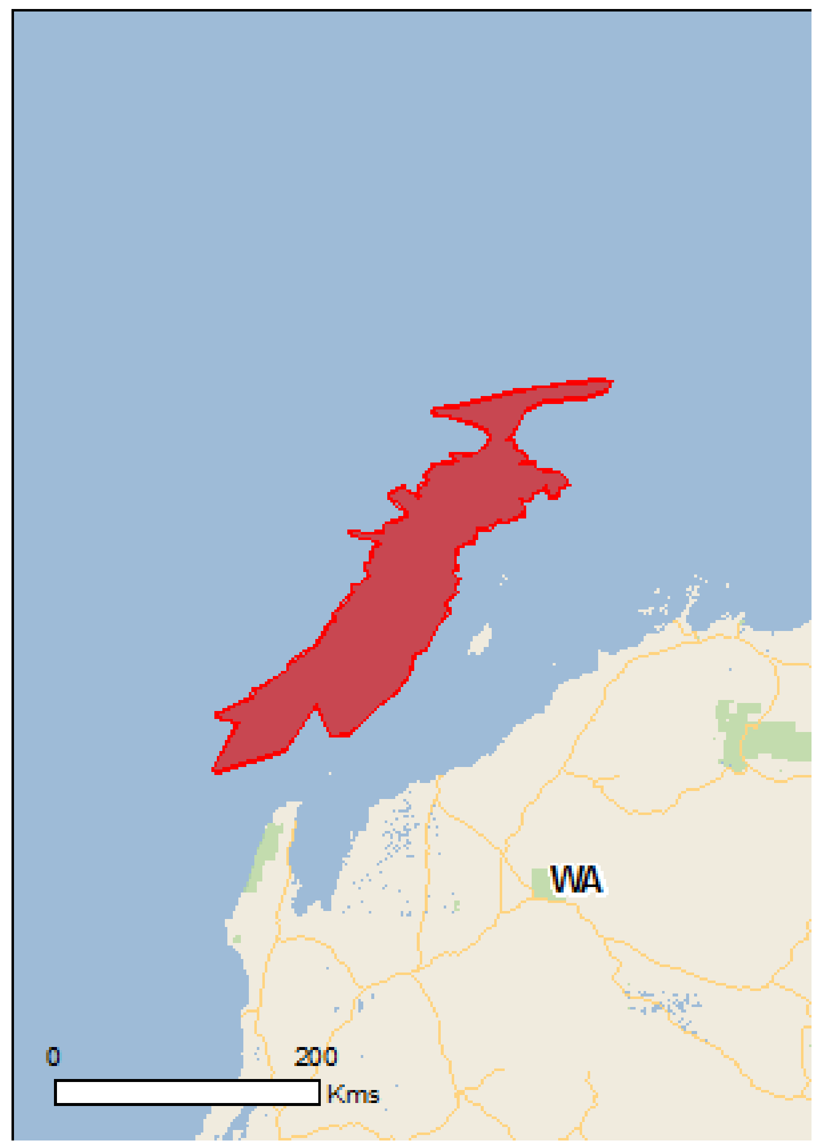

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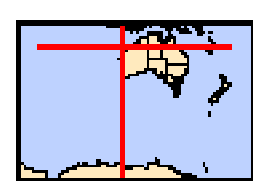

Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	22
Listed Migratory Species:	38

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 http://www.environment.gov.au/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 Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	70
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	3

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 the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	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
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
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

Name	Status	Type of Presence
		to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to 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
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	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 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

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely 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
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
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
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
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known 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 clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known 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 chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may 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
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
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
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely 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]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	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
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat may occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		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 latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		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
Cosmocampus banneri Roughridge Pipefish [66206]		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 multiannulatus Many-banded Pipefish [66717]		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 scalaris Ladder Pipefish [66216]		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 grayi Mud Pipefish, Gray's Pipefish [66221]		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

Name	Threatened	Type of Presence
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
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 micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		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
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		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
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area

Name	Threatened	Type of Presence
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely 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
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	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 simus Dwarf Sperm Whale [58]		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]	Vulnerable	Species or species habitat 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

Name	Status	Type of Presence
		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
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may 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 may 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]

Name	Label
Gascoyne	Multiple Use Zone (IUCN VI)
Montebello	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [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
Canyons linking the Cuvier Abyssal Plain and the	North-west
Continental Slope Demersal Fish Communities	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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 distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-19.3243 115.0675,-19.3404 115.0778,-19.3523 115.1478,-19.3874 115.3162,-19.4044 115.3683,-19.442 115.4383,-19.492 115.4581,-19.5483 115.4285,-19.5911 115.3629,-19.608 115.3135,-19.5918 115.2245,-19.5944 115.1999,-19.6087 115.1941,-19.6355 115.2414,-19.6507 115.2376,-19.6533 115.2016,-19.6549 115.1495,-19.6664 115.1011,-19.6724 115.0703,-19.7175 115.0396,-19.7186 115.0291,-19.7383 115.0173,-19.7626 115.0312,-19.8043 115.0123,-19.7944 114.9995,-19.8075 114.9784,-19.8361 114.97,-19.8581 114.9875,-19.8811 114.9593,-19.8126 114.8708,-19.8158 114.8451,-19.8387 114.8017,-19.8495 114.7713,-19.8693 114.7723,-19.9223 114.8328,-19.961 114.8841,-19.9962 114.8956,-20.0287 114.803,-20.0401 114.7529,-20.0701 114.7314,-20.1022 114.7243,-20.1054 114.6436,-20.0861 114.5319,-20.0945 114.509,-20.1117 114.5165,-20.1535 114.6913,-20.1644 114.7209,-20.2027 114.6651,-20.2277 114.655,-20.242 114.6633,-20.2904 114.6341,-20.2946 114.6135,-20.3138 114.6118,-20.374 114.6305,-20.4258 114.5707,-20.4285 114.547,-20.4312 114.5256,-20.4448 114.5164,-20.4705 114.5253,-20.5375 114.4736,-20.5809 114.4343,-20.6191 114.3895,-20.6372 114.4031,-20.6616 114.396,-20.6845 114.3532,-20.7152 114.3489,-20.8148 114.2725,-20.9149 114.1235,-20.9339 114.0931,-20.971 114.0859,-21.0935 113.8911,-21.1021 113.8525,-21.1481 113.8355,-21.207 113.7027,-21.2483 113.6015,-21.2701 113.5998,-21.2875 113.6713,-21.3088 113.7441,-21.5952 113.5797,-21.6108 113.6016,-21.4799 114.0529,-21.3867 114.1265,-21.2351 114.2395,-21.1904 114.2695,-21.383 114.3678,-21.3768 114.4884,-21.3029 114.5815,-21.2135 114.6728,-21.1175 114.8064,-21.004 114.9085,-20.8784 114.9381,-20.8364 115.0159,-20.6772 115.104,-20.6001 115.1691,-20.544 115.1543,-20.5183 115.1743,-20.4764 115.2342,-20.4413 115.2143,-20.39 115.2393,-20.3572 115.1921,-20.3269 115.2221,-20.2732 115.2147,-20.2242 115.2198,-20.1799 115.2373,-20.1591 115.3342,-20.1078 115.3641,-20.0682 115.3691,-20.0753 115.4436,-20.0426 115.4834,-20.0217 115.5331,-20.0264 115.5703,-20.0077 115.6125,-19.989 115.6771,-19.94 115.6871,-19.8887 115.6498,-19.8933 115.7218,-19.8396 115.7491,-19.8278 115.8112,-19.8044 115.836,-19.8698 115.8635,-19.865 115.9082,-19.8183 115.9181,-19.7924 115.9803,-19.7597 115.9728,-19.7108 115.918,-19.7087 115.8509,-19.6995 115.7764,-19.6575 115.7515,-19.667 115.6548,-19.653 115.6548,-19.6179 115.6994,-19.5969 115.687,-19.5596 115.6201,-19.5128 115.6127,-19.5059 115.5632,-19.4731 115.6053,-19.4029 115.65,-19.3256 115.6823,-19.2572 115.8287,-19.2372 116.0795,-19.1891 116.2513,-19.1324 116.2788,-19.1282 116.2165,-19.146 116.0224,-19.168 115.8238,-19.1967 115.6478,-19.2438 115.4274,-19.2974 115.2219,-19.3087 115.0759,-19.3243 115.0675

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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Australian Government
Department of the Environment and Energy

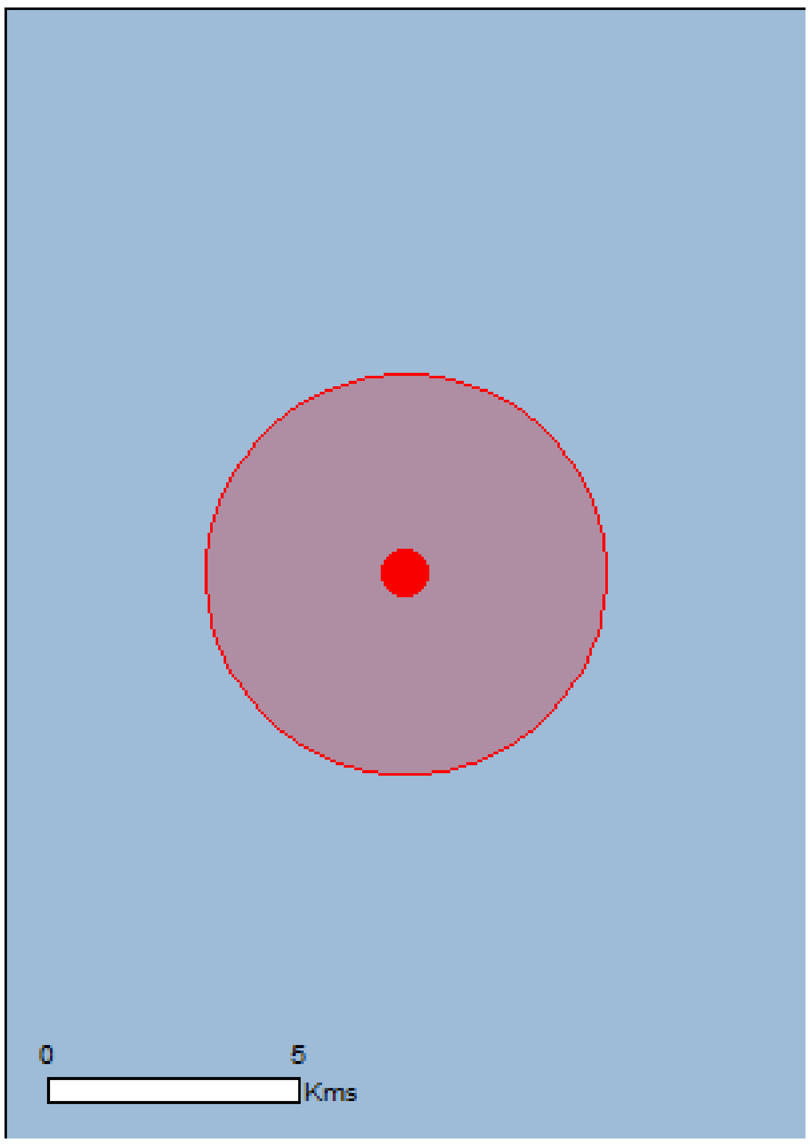
EPBC Act Protected Matters Report

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.

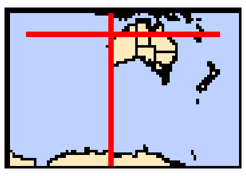
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 15/11/19 20:29:01



Coordinates
Buffer: 4.0Km



Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	18
Listed Migratory Species:	32

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 http://www.environment.gov.au/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 Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	59
Whales and Other Cetaceans:	24
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

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 the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	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
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Mammals		
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
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Reptiles		
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
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Sharks		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	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
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

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
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 likely to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Migratory Marine Species		
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

Name	Threatened	Type of Presence
		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
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
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
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known 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 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 Wetlands Species

Name	Threatened	Type of Presence
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
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
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	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
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		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 latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		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 scalaris Ladder Pipefish [66216]		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 grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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
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 trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		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
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		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
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area

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	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dophin, 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 simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat 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
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

Name	Status	Type of Presence
		habitat may 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

Extra Information

Key Ecological Features (Marine) [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

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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 distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-20.1469 115.041

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 PREPAREDNESS AND RESPONSE MITIGATION ASSESSMENT

Oil Spill Preparedness and Response Mitigation Assessment for WA-49-L Gemtree Anchor Hold Testing Environment Plan

Security & Emergency Management
Hydrocarbon Spill Preparedness Unit

December 2019

Revision: 0

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FIGURES

TABLES

EXECUTIVE SUMMARY

Woodside Energy Julimar Pty Ltd (Woodside) has developed its oil spill preparedness and response position for the WA-49-L Gemtree Anchor Hold Testing Environment Plan, hereafter known as the Petroleum Activities Program (PAP).

This document demonstrates that the risks and impacts from an unplanned hydrocarbon release, and the associated response operations, are controlled to As Low As Reasonably Practicable (ALARP) and Acceptable levels. It achieves this by evaluating response options to address the potential environmental impacts resulting from an unplanned loss of hydrocarbon containment associated with the PAP described in the Environment Plan (EP). This document then outlines Woodside's decisions and techniques for responding to a hydrocarbon release event and the process for determining its level of hydrocarbon spill preparedness.

A summary of the key facts and references to additional detail within this document are presented below.

Table 0-1: Summary of the key details for assessment

Key details of assessment	Summary	Reference to additional detail
Worst Case Credible Scenario	Hydrocarbon release due to vessel collision Surface – instantaneous release of 275 m^3 of marine diesel. Residue of 13.75 m^3.	Section 2.2
Hydrocarbon Properties	**Marine Diesel (API 37.2)** In general, about 6% of the oil mass should evaporate within the first 12 hours (BP < 180 °C); a further 35% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and a further 54% should evaporate over several days (265 °C < BP < 380 °C). Approximately 5% of the oil is shown to be persistent (13.75 m^3). If released in the marine environment and in contact with the atmosphere, 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 have a tendency to entrain into the upper water column due to wind-generated waves but can subsequently resurface if wind-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.	Section 2.2.1 Section 6.7 of the EP Appendix A of the First Strike Plan
Modelling Results	**Stochastic modelling** Modelling of a 550 m^3 surface release of marine diesel was available for Woodside's Balnaves Development, conducted in 2016. The release location used for the spill modelling is located approximately 50 km north-west of the Montebello Islands and approximately 5 km from the Gemtree Operational Area. The modelled spill volume of 550 m^3 is greater than the worst-case credible release volume of 275 m^3 for this EP. However, the results of the modelling can be used to demonstrate that a much larger marine diesel spill in the vicinity of the Operational Area has an Environment that May Be Affect (EMBA) that is not predicted to include any surface slicks above threshold volumes entering WA state waters, or any shoreline contact or accumulation. Basing the impact assessment for a vessel collision scenario on this modelling is considered highly conservative and consequently, the EMBA for a 275 m^3 surface release of marine diesel within the Operational Area would be considerably smaller than the EMBA described in this EP. For the selected spill model, a total of 50 replicate simulations, of 42 days' duration for each of four quarterly periods, were completed for the scenario to test for trends and variations in the trajectory and weathering of the spilled oil. The modelled outputs were subsequently annualised.	Section 2.3

Key details of assessment	Summary		Reference to additional detail
	Minimum time to shoreline contact (above 100 g/m^2)	No contact at threshold	
	Largest volume ashore at any single Response Protection Area (RPA) (above 100 g/m^2)	No contact at threshold	
	Largest total shoreline accumulation (above 100 g/m^2) across all shorelines	No contact at threshold	
Net Environmental Benefit Assessment	Monitor and evaluate, vessel source control if feasible and oiled wildlife response (if required) are all identified as potentially having a net environmental benefit (dependent on the actual spill scenario) and are carried forward for further assessment.		Section 4
ALARP evaluation of selected response techniques	The evaluation of the selected response techniques shows the proposed controls reduced the risk to an ALARP and Acceptable level for the risks and impacts presented in Section 2 and Section 3, including the implementation of considered additional, alternative or improved control measures.		Section 6

1 INTRODUCTION

1.1 Overview

Woodside has developed its oil spill preparedness and response position for the WA-49-L Gemtree Anchor Hold Testing EP, hereafter known as the PAP. This document outlines Woodside's decisions and techniques for responding to a hydrocarbon loss of containment event and the process for determining its level of hydrocarbon spill preparedness.

1.2 Purpose

This document, together with the documents listed below, meet the requirements of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Environment Regulations) relating to hydrocarbon spill response arrangements.

- the WA-49-L Gemtree Anchor Hold Testing EP
- Oil Pollution Emergency Arrangements (OPEA) (Australia)
- the WA-49-L Gemtree Anchor Hold Testing Oil Pollution Emergency Plan (OPEP) including:
  - First Strike Plan (FSP)
  - relevant Operations Plans
  - relevant Tactical Response Plans (TRPS)
  - relevant Supporting Plans
  - data directory.

1.3 Scope

This document evaluates response options to address the potential environmental risks and impacts resulting from an unplanned loss of hydrocarbon containment associated with the PAP described in the EP. It then outlines Woodside's decisions and techniques for responding to a hydrocarbon release event and the process for determining its level of hydrocarbon spill preparedness. It should be read in conjunction with the documents listed in Table 1-1. The location of the PAP is shown in Figure 3.2 of the EP.

1.4 Oil spill response document overview

The documents outlined in Table 1-1 and Figure 1-1 are collectively used to manage the preparedness and response for a hydrocarbon release.

ANNEX A contains a pre-operational Net Environmental Benefit Analysis (NEBA) summary, outlining the selected response techniques for this PAP. Relevant Operational Plans to be initiated for associated response techniques are identified in the FSP and relevant forms to initiate a response are appended to the FSP.

The process to develop an Incident Action Plan (IAP) begins once the FSP is underway. The IAP includes inputs from the monitor and evaluate operations and the operational NEBA (Section 4). Planning, coordination and resource management are initiated by the Incident Management Team (IMT). In some instances, technical specialists may be utilised to provide expert advice. The planning may also involve liaison officers from supporting government agencies.

During each operational period, field reports are continually reviewed to evaluate the effectiveness of response operations. In addition, the operational NEBA is continually reviewed and updated to ensure the response techniques implemented continue to result in a net environmental benefit (see Section 4). The response will continue as described in Section 5 until the response termination criteria have been met as set out in ANNEX B: Operational Monitoring Activation and Termination Criteria.

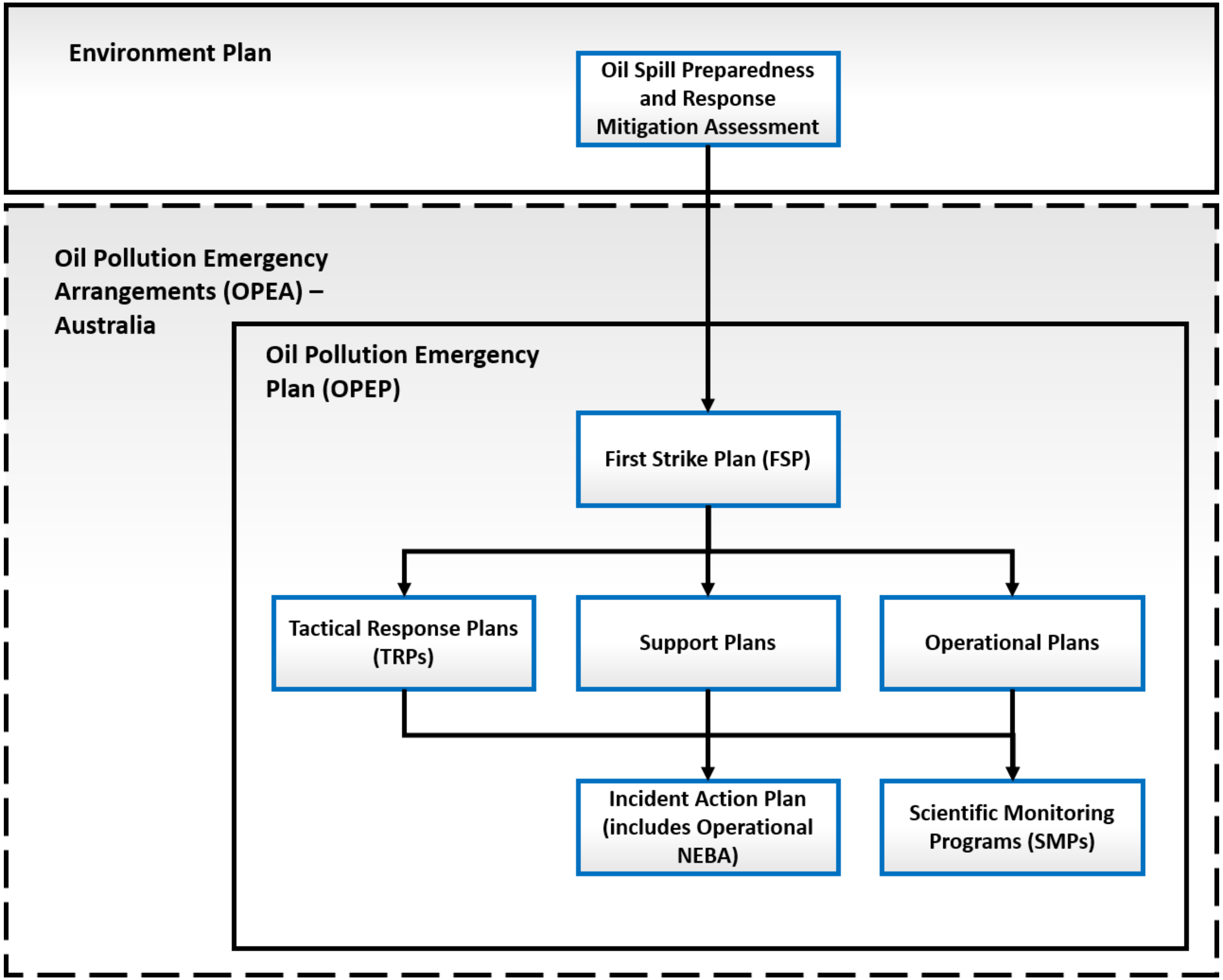

Figure 1-1: Woodside hydrocarbon spill document structure

Table 1-1: Hydrocarbon spill preparedness and response – document references

Document	Document overview	Stakeholders	Relevant information	Document subsections (if applicable)
WA-49-L Gemtree Anchor Hold Testing EP	Demonstrates that potential adverse impacts on the environment associated with the WA-49-L Gemtree Anchor Hold Testing (during both routine and non-routine operations) are mitigated and managed to ALARP and will be of an acceptable level.	NOPSEMA Woodside internal	EP Section 6 (Environmental Risk Assessment, Performance Outcomes, Standards and Measurement Criteria). EP Section 7 (Implementation strategy – including emergency preparedness and response). EP Section 7 (Reporting and compliance).	
OPEA Australia	Describes the arrangements and processes adopted by Woodside when responding to a hydrocarbon spill from a petroleum activity.	Regulatory agencies Woodside internal	All	
OSPRMA for the WA-49-L Gemtree Anchor Hold Testing (this document)	Evaluates response options to address the potential environmental impacts resulting from an unplanned loss of hydrocarbon containment associated with the PAP described in the EP.	Regulatory agencies Corporate Incident Control Centre (CICC): Control function in an ongoing spill response for activity-specific response information.	All performance outcomes, standards and measurement criteria related to hydrocarbon spill preparedness and response are included in this document.	
WA-49-L Gemtree Anchor Hold Testing Oil Pollution FSP	Facility specific document providing details and tasks required to mobilise a first strike response. Primarily applied to the first 24 hours of a response until a full IAP specific to the event is developed. Oil Pollution FSPs are intended to be the first document used to provide immediate guidance to the responding IMT.	Site-based IMT for initial response, activation and notification. CICC for initial response, activation and notification. CICC: Control function in an ongoing spill response for activity-specific response information.	Initial notifications and reporting required within the first 24 hours of a spill event. Relevant spill response options that could be initiated for mobilisation in the event of a spill. Recommended pre-planned tactics. Details and forms for use in immediate response. Activation process for oil spill trajectory	

Document	Document overview	Stakeholders	Relevant information	Document subsections (if applicable)
			modelling, aerial surveillance and oil spill tracking buoy details.	
Operational Plans	Lists the actions required to activate, mobilise and deploy personnel and resources to commence response operations. Includes details on access to equipment and personnel (available immediately) and steps to mobilise additional resources depending on the nature and scale of a release. Relevant operational plans will be initially selected based on the Oil Pollution First Strike Plan; additional operational plans will be activated depending on the nature and scale of the release.	CICC: Operations and Logistics functions for first strike activities. CICC: Planning Function to help inform the IAP on resources available.	Locations from where resources may be mobilised. How resources will be mobilised. Details of where resources may be mobilised to and what facilities are required once the resources arrive. Details on how to implement resources to undertake a response.	Operational Monitoring Plan Vessel Shipboard Oil Pollution Emergency Plan (SOPEP) Oiled Wildlife Scientific Monitoring
Tactical Response Plans	Provides options for response techniques in selected Response Protection Areas (RPAs). Provides site, access and deployment information to support a response at the location.	CICC: Planning Function to help develop IAPs, and Logistics function to assist with determining resources required.	Indicative response techniques. Access requirements and/or permissions. Relevant information for undertaking a response at that site. Where applicable, may include equipment deployment locations and site layouts.	Mangrove Bay Turquoise Bay Yardie Creek Ningaloo Reef - Refer to Mangrove/Turquoise bay and Yardie Creek Barrow and Lowendal Islands Montebello Island – Stephenson Channel Nth TRP Montebello Island – Champagne Bay and Chippendale channel TRP Montebello Island – Claret Bay TRP Montebello Island – Hermite/Delta Island Channel TRP Montebello Island – Hock Bay TRP Montebello Island – North and Kelvin Channel TRP

Document	Document overview	Stakeholders	Relevant information	Document subsections (if applicable)
				Montebello Island – Sherry Lagoon Entrance TRP Muiron Islands Rankin Bank & Glomar Shoals
Support Plans	Support Plans detail Woodside's approach to resourcing and the provision of services during a hydrocarbon spill response.	CICC: Operations, Logistics and Planning functions.	Strategy for mobilising and managing additional resources outside of Woodside's immediate preparedness arrangements.	Marine Logistics People and Global Capability Surge Labour Requirement Plan Health and Safety Aviation IT (First Strike Response) IT (Extended Response) Communications (First Strike Response) Communications (Extended Response) Stakeholder Engagement Accommodation and Catering Waste Management Guidance for Oil Spill Claims Management (Land based) Security Support Plan Hydrocarbon Spill Responder Health Monitoring Guideline

2 RESPONSE PLANNING PROCESS

This document details Woodside's process for identifying potential response options for the hydrocarbon release scenarios identified in the EP. Figure 2-1 outlines the interaction between Woodside's response, planning/preparedness and selection process.

This structure has been used because it shows how the planning and preparedness activities inform a response and provides indicative guidance on what activities would be undertaken, in sequential order, if a real event were to occur. The process also evaluates alternative, additional and/or improved control measures specific to the PAP.

The WA-49-L Gemtree Anchor Hold Testing Oil Spill FSP then summarises the outcome of the response planning process and provides initial response guidance and a summary of ongoing response activities, if an incident were to occur.

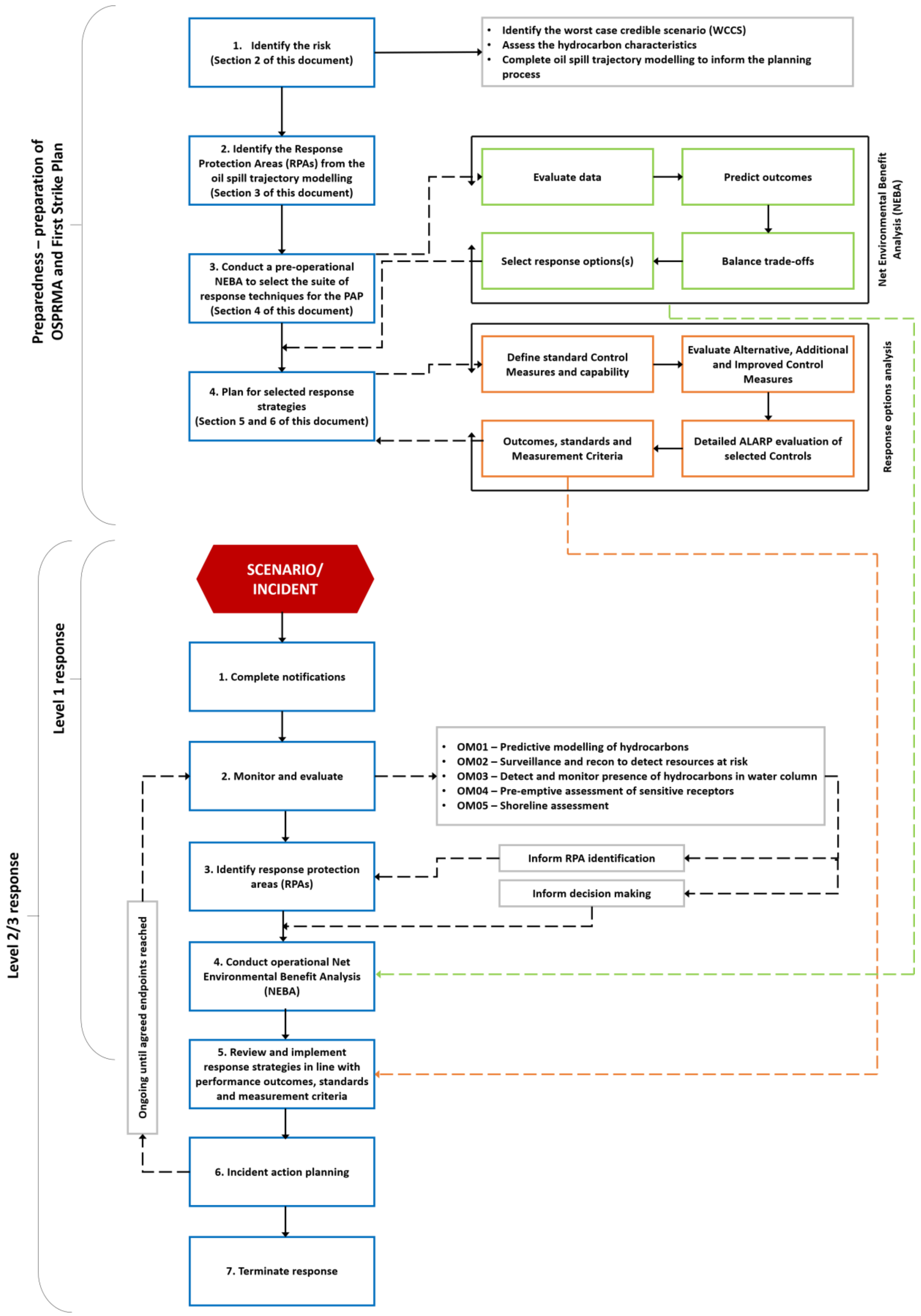

Figure 2-1: Response planning and selection process

2.1 Response planning process outline

This document is expanded below to provide additional context on the key steps in determining capability, evaluating ALARP and hydrocarbon spill response requirements.

Section 1. INTRODUCTION

Section 2. RESPONSE PLANNING PROCESS

- identification of worst-case credible scenario(s) (WCCS)
- spill modelling for WCCS

Section 3. IDENTIFY RESPONSE PROTECTION AREAS (RPAs)

- areas predicted to be contacted at concentration >100 g/m^2.

Section 4. NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA)

- pre-operational NEBA (during planning/ALARP evaluation): this must be reviewed during the initial response to an incident to ensure its accuracy
- selected response techniques prioritised and carried forward for ALARP assessment

Section 5. HYDROCARBON SPILL ALARP PROCESS

- determines the response need based on predicted consequence parameters.
- details the environmental performance of the selected response options based on the need.
- sets the environmental performance outcomes, environmental performance standards and measurement criteria.

Section 6. ALARP EVALUATION

- evaluates alternative, additional, and improved options for each response technique to demonstrate the risk has been reduced to ALARP.
- provides a detailed ALARP assessment of selected control measure options against:
  - predicted cost associated with implementing the option
  - predicted change to environmental benefit
  - predicted effectiveness / feasibility of the control measure

Section 7. ENVIRONMENTAL RISK ASSESSMENT OF SELECTED RESPONSE TECHNIQUES

- evaluation of impacts and risks from implementing selected response options

Section 8. ALARP CONCLUSION

Section 9. ACCEPTABILITY CONCLUSION

2.1.1 Response Planning Assumptions – Timing, Resourcing and Effectiveness

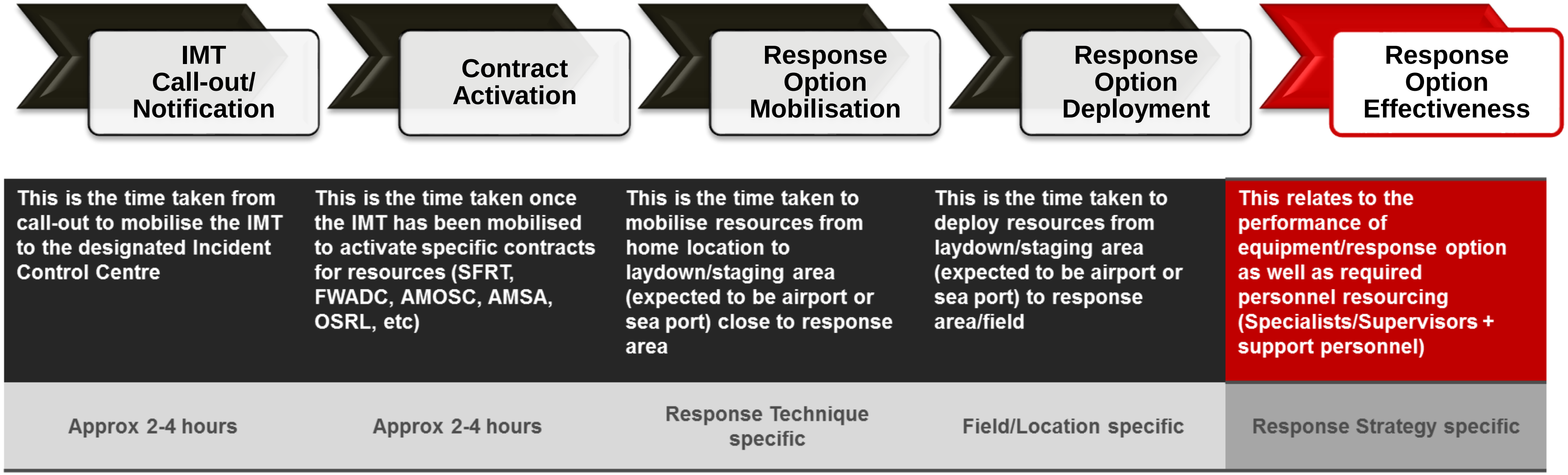

Figure 2-2: Response Planning Assumptions – Timing, Resourcing and Effectiveness

2.2 Environment plan risk assessment (credible spill scenarios)

One potential hydrocarbon release scenario from the PAP was identified during the risk assessment process (Section 6 of the EP). Further descriptions of risk, impacts and mitigation measures (which are not related to hydrocarbon preparedness and response) are provided in Section 6 of the EP.

Table 2-1 presents the unplanned event/ credible spill scenario for the PAP. This is deemed as representative of the type, source and incident or response level and will be used as the WCCS for response planning purposes. By demonstrating capability to manage the response to the WCCS, Woodside assumes other scenarios that are smaller in nature and scale can also be managed by the same capability. Response performance measures have been defined based on a response to the WCCS.

Table 2-1: Petroleum Activities Program credible spill scenario

MEE No.	Scenario selected for planning purposes	Scenario description	Maximum credible volume released (liquid m^3)	Incident Level	Hydrocarbon (HC) type	Residual proportion	Residual volume (liquid m^3)	Key credible scenarios informing response planning
MEE-01 WCCS	Yes	Hydrocarbon release due to vessel collision	Instantaneous release of 275 m^3 marine diesel[1]	2	Marine diesel	5%	13.75 m^3	Release of up to 275 m^3 marine diesel from the anchor hold test vessel due to collision.

[1] *Please note that modelling of a 550 m^3 surface release of marine diesel from Woodside's Balnaves Development, conducted in 2016, was available and used for the analysis within this document. The release location used for the spill modelling is located approximately 50 km north-west of the Montebello Islands and approximately 5 km from the Gemtree Operational Area. The modelled spill volume of 550 m^3 is greater than the worst-case credible release volume of 275 m^3 for this EP. However, the results of the modelling can be used to demonstrate that a much larger marine diesel spill in the vicinity of the Operational Area has an Environment that May Be Affect (EMBA) that is not predicted to include any surface slicks above threshold volumes entering WA state waters, or any shoreline contact or accumulation. Basing the impact assessment for a vessel collision scenario on this modelling is considered highly conservative and consequently, the EMBA for a 275 m^3 surface release of marine diesel within the Operational Area would be considerably smaller than the EMBA described in this EP.*

2.2.1 Hydrocarbon characteristics

More detailed hydrocarbon characteristics, including modelled weathering data and ecotoxicity, are included in Section 6 of the EP.

Marine diesel

Marine Diesel Oil is typically classed as an International Tanker Owners Pollution Federation (ITOPF) Group I/II oil. Marine diesel is a mixture of volatile and persistent hydrocarbons with low proportions of highly volatile and residual components. In general, about 6% of the oil mass should evaporate within the first 12 hours (BP < 180 °C); a further 35% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and a further 54% should evaporate over several days (265 °C < BP < 380 °C). 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. a 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 have a tendency to entrain into the upper water column due to wind-generated waves but can subsequently resurface if wind-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.

It is predicted that 13.75 m^3 of product would remain after weathering from the marine diesel scenario (MEE-01).

2.3 Hydrocarbon spill modelling

Oil spill trajectory modelling (OSTM) tools are used for environmental impact assessment and during response planning to understand spatial scale and timeframes for response operations. Woodside recognises that there is a degree of uncertainty related to the use of modelling data and has subsequently utilised conservative approaches to volumes, weathering, spatial areas, timing and response effectiveness to scale capability to need.

The Oil Spill Model and Response System (OILMAP) and Integrated Oil Spill Impact Model System (SIMAP) models are both used for stochastic and deterministic trajectory modelling. They have been developed over three decades of planning, exercises, actual responses, several peer reviews, and validation studies. OILMAP was originally derived from the United States Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Type A model (French et al. 1996), for assessing marine transport, biological impact and economic damage that was also used under the United States Oil Pollution Act 1990 Natural Resource Damage Assessment (NRDA) regulations. Notable spills where the model has been used and validated against actual field observations include, Exxon Valdez (French McCay 2004), North Cape Oil Spill (French McCay 2003), along with an assessment of 20 other spills (French McCay and Rowe, 2004). In addition, test spills designed to verify fate, weathering and movement algorithms have been conducted regularly and in a range of climate conditions (French and Rines 1997; French et al. 1997; Payne et al. 2007; French McCay et al. 2007).

Further to this, the algorithms have been updated using the latest findings from the Macondo/Deepwater Horizon well blowout in the Gulf of Mexico and validated according to the Deepwater Horizon (DWH) oil spill in support of the NRDA (Spaulding et al. 2015; French McCay et al. 2015, 2016). Finally, the OILMAP and SIMAP models have been used extensively in Australia to prosecute pollution offences, predict discharge locations and likely spill volumes based on weathering and surveillance observations, and have been used by expert witnesses in Australian court proceedings in estimating the quantum of a spill.

2.3.1 Stochastic modelling

Stochastic modelling of a 550 m^3 surface release of marine diesel was available for Woodside's Balnaves Development, conducted in 2016. The release location used for the spill modelling is located approximately 50 km north-west of the Montebello Islands and approximately 5 km from the Gemtree Operational Area. The modelled spill volume of 550 m^3 is greater than the worst-case credible release volume of 275 m^3 for this EP. However, the results of the modelling can be used to demonstrate that a much larger marine diesel spill in the vicinity of the Operational Area has an Environment that May Be Affect (EMBA) that is not predicted to include any surface slicks above threshold volumes entering WA state waters, or any shoreline contact or accumulation. Basing the impact assessment for a vessel collision scenario on this modelling is considered highly conservative and consequently, the EMBA for a 275 m^3 surface release of marine diesel within the Operational Area would be considerably smaller than the EMBA described in this EP.

For the selected spill model, a total of 50 replicate simulations, of 42 days' duration for each of four quarterly periods, were completed for the scenario to test for trends and variations in the trajectory and weathering of the spilled oil. The modelled outputs were subsequently annualised. Woodside considered commissioning bespoke modelling for this PAP and it was determined that the outputs would not provide a significantly different understanding of the consequences of a diesel spill. In addition, the predictions of extent, severity, and duration of diesel released are also within the assumptions and case made in Reference Case 2018:1003 – Consequence analysis of an accidental release of diesel (National Energy Resources Australia (NERA), 2018).

For the selected spill model, a total of 50 replicate simulations, of 42 days' duration for each of four quarterly periods, were completed for the scenario to test for trends and variations in the trajectory and weathering of the spilled oil. The modelled outputs were subsequently annualised. Further details relating to the assessments for the scenarios can be found in Section 6 of the EP.

2.3.1.1 Environmental impact thresholds – Environment that May Be Affected (EMBA) and hydrocarbon exposure

The outputs of the stochastic spill modelling are used to assess the potential environmental impact from the credible scenarios. The stochastic modelling results are used to delineate areas of the marine and shoreline environment that could be exposed to hydrocarbon levels exceeding environmental impact threshold concentrations. The summary of all the locations where hydrocarbon thresholds could be exceeded by any of the simulations modelled is defined as the EMBA and is discussed further in Section 6 of the EP. As the weathering of different fates of hydrocarbons (surface, entrained and dissolved) differs due to the influence of the metocean mechanism of transportation, a different EMBA is presented for each fate within the EP.

A conservative approach – adopting accepted contact thresholds for impacts on the marine environment – is used to define the EMBA. These hydrocarbon thresholds are presented in Table 2-2 below and described in Section 6 of the EP.

Table 2-2: Summary of thresholds applied to the stochastic hydrocarbon spill modelling of marine diesel to determine the EMBA and environmental impacts

Theshold	Description
1 g/m^2	Surface hydrocarbon
10 g/m^2	Surface hydrocarbon
500 ppb	Entrained hydrocarbon (ppb)
500 ppb	Dissolved aromatic hydrocarbon (ppb)
100 g/m^2	Shoreline accumulation

2.3.2 Deterministic modelling

The selected stochastic modelling used as representative of this PAP did not predict the threshold concentrations required to trigger the undertaking of deterministic modelling. Despite not being undertaken, information regarding deterministic surface concentration thresholds has been retained in this document to demonstrate the feasibility of the various response techniques.

Woodside uses deterministic modelling results to evaluate risks and impacts and response capability requirements. These results are provided in both shapefile and data table format with each row of the data table representing a 1 km^2 cell. This cell size has been used as it represents the approximate area that a single containment and recovery operation or surface dispersant operation (single sortie or vessel spraying) can effectively treat in one ten (10) hour day. Smaller cell sizes have been considered but would not change the response need as the potential distance between cells would not allow multiple cells to be treated per day by response operations. Additionally, a 1 km^2 cell is expected to allow averaging of threshold concentrations and mass across the spatial extent to represent a conservative approach (patches of oil and windrows) to response planning that simulates operational monitoring feedback in a real event.

A sample of these deterministic results from a previous PAP is provided below as an indication of the data format and content.

- Column A and B provide the latitude and longitude of the cell
- Column C is the elapsed time since the release occurred
- Column D represents the average concentration across the cell in g/m^2
- Column E represents the viscosity of the hydrocarbon in centistokes (cSt) at sea surface temperature
- Column F and G represent the mass of hydrocarbon across the entire cell in kg and tonnes (rounded to nearest whole tonne) respectively.

Table 2-3: Example deterministic modelling data

Latitude	Longitude	Time_hour	Conc_gm^2	Visc_cSt	Mass_kg	Mass_ tonnes
A	B	C	D	E	F	G
-19.449291	116.445009	6	2.337393	82.261904	2346.834779	2
-19.458323	116.454564	6	3.904446	82.019348	3919.990957	4
-19.449291	116.454564	6	10.141920	82.122816	10182.875395	10
-19.440258	116.454564	6	1.559455	82.177729	1565.840662	2
-19.458323	116.464119	6	8.628178	81.472017	8662.519664	9
-19.449291	116.464119	6	13.686730	81.834673	13741.982430	14
-19.467355	116.473674	6	1.192110	79.455729	1196.785212	1
-19.458323	116.473674	6	23.075033	79.218639	23166.844726	23
-19.449291	116.473674	6	2.359922	81.058523	2346.834779	2

The deterministic modelling data provides an indication of the response need by displaying the potential surface area and volume that may be treated or recovered by response operations. Existing capability is reviewed to approximate the surface area and volumes that can be treated or removed and a range of alternate, improved and additional options, to reduce risks and impacts to ALARP, are considered.

Woodside recognises that no single response technique will treat all available subsea or surface oil and that a combination of response techniques will be required for the identified scenario. Even with the significant resources available to Woodside through existing capability and third-party resources, the primary offshore response techniques of surface dispersant application and containment and recovery will only treat or recover a minor proportion (<30%) of the available surface hydrocarbons based on previous response experience.

Woodside is committed to a realistic, scalable response capability that is commensurate to the level of risk and able to be practically implemented and feasibly sustained.

2.3.2.1 Response planning thresholds for surface and shoreline hydrocarbon exposure

Thresholds to determine the EMBA are used to predict and assess environmental impacts and inform the Scientific Monitoring Program (SMP), however they do not appropriately represent the thresholds at which an effective response can be implemented. Additional response thresholds are used for response planning and to determine areas where response techniques would be most effective. The deterministic modelling is then used to assess the nature and scale of a response.

In the event of an actual response, any existing deterministic modelling would be reviewed for suitability and additional modelling would be conducted using real-time data and field information to inform IMT decisions.

Surface spill concentrations are expressed as grams per square metre (g/m^2) and are presented at response planning thresholds for surface hydrocarbons for the WCCS. The thresholds used are derived from oil spill response planning literature and industry guidance and are summarised below.

2.3.2.2 Surface hydrocarbon concentrations

Table 2-4: Surface hydrocarbon thresholds for response planning

Surface hydrocarbon threshold (g/m²)	Description	Bonn Agreement Oil Appearance Code	Mass per area (m³/km²)
>10	Predicted minimum threshold for commencing operational monitoring[2]	Code 3 – Dull metallic colours	5 to 50
50	Predicted minimum floating oil threshold for containment and recovery and surface dispersant application [3]	Code 4 – Discontinuous true oil colour	50 to 200
100	Predicted optimum floating oil threshold for containment and recovery and surface dispersant application	Code 5 – Continuous true oil colour	>200
Shoreline hydrocarbon threshold **(g/m²)**	**Description**	**National Plan Guidance on Oil Contaminated Foreshores**	**Mass per area** (m³/km²)
100	Predicted minimum shoreline accumulation threshold for shoreline assessment operations	Stain	>100
250	Predicted minimum threshold for commencing shoreline cleanup operations	Level 3 – Thin Coating	200 to 1000

The surface thickness of oil at which dispersants are typically effective is approximately 100 g/m². However, substantial variations occur in the thickness of the oil within the slick, and most fresh crude oils spread within a few hours, so that overall the average thickness is 0.1 mm (or approx. 100 g/m²) (International Tanker Owners Pollution Federation [ITOPF] 2011). Additionally, the recommended rate of application for surface dispersant is typically 1-part dispersant to 20 or 25 parts of spilled oil. These figures assume a 0.1 mm slick thickness, averaged over the thickest part of the spill, to calculate a litres/hectare application rate from vessels and aircraft. In practice this can be difficult to achieve as it is not possible to accurately assess the thickness of the floating oil.

Some degree of localised over-dosage and under-dosage is inevitable in dispersant response. An average oil layer thickness of 0.1 mm is often assumed, although the actual thickness can vary over a wide range (from less than 0.0001 mm to more than 1 mm) over short distances (International Petroleum Industry Environment Conservation Association [IPIECA] 2015).

Guidance from the Australian Maritime Safety Authority (AMSA, 2015) indicates that spreading of spills of Group II or III products will rapidly decrease slick thickness over the first 24 hours of a spill resulting in the potential requirement of up to a ten (10) fold increase in capability on day 2 to achieve the same level of performance.

Further guidance from the European Maritime Safety Authority (EMSA) states that spraying the ‘metallic’ looking area of an oil slick (Bonn Agreement Oil Appearance Code [BAOAC] 3, approx. 5 – 50 µm) with dispersant from spraying gear designed to treat an oil layer 0.1 mm (100 µm) thick, will inevitably cause dispersant over-treatment by a factor of 2 to 20 times (EMSA 2012).

Therefore, dispersant application should be concentrated on the thickest areas of an oil slick and Woodside intends on applying surface dispersants to only BAOAC 4 and 5. Spraying areas of oil

[2] Operational monitoring will be undertaken from the outset of a spill whether or not this threshold has been reached. Monitoring is needed throughout the response to assess the nature of the spill, track its location and inform the need for any additional monitoring and/or response techniques. It also informs when the spill has entered State Waters and control of the incident passes to statutory authorities e.g. WA DoT or AMSA.

[3] At 50g/m², containment and recovery and surface dispersant application operations are not expected to be particularly effective. This threshold represents a conservative approach to planning response capability and containing the spread of surface oil.

designated as BAOAC Code 4 (Discontinuous true oil colour) with dispersant will, on average, deliver approximately the recommended treatment rate of dispersant.

Spraying areas of oil designated as BAOAC Code 5 with dispersant (Continuous true oil colour and more than 0.2 mm thick) will, on average, deliver approximately half the recommended treatment rate of dispersant. Repeated application of these areas of thicker oil, or increased dosage ratios, will be required to achieve the recommended treatment rate of dispersant (EMSA 2012).

Guidance from the National Oceanic and Atmospheric Administration (NOAA) in the United States is found in the document: *Characteristics of Response Strategies: A Guide for Spill Response Planning in Marine Environments 2013 (NOAA 2013).* This guide outlines advice for response planning across all common techniques, including surface dispersant spraying and containment and recovery. It states that oil thickness can vary by orders of magnitude within distinct areas of a slick, thus the actual slick thickness and oil distribution of target areas are crucial for determining response method feasibility. Further to this, ITOPF also states that in terms of oil spill response, sheen can be disregarded as it represents a negligible quantity of oil, cannot be recovered or otherwise dealt with to a significant degree by existing response techniques, and is likely to dissipate readily and naturally (ITOPF, 2014).

Figure 2-3 below from AMSA's Identification of Oil on Water – Aerial Observation and Identification Guide (AMSA, 2014) shows expected percent coverage of surface hydrocarbons as a proportion of total surface area. Wind-rows, heavy oil patches and tar balls, for example, must be considered, as they influence oil encounter rates, chemical dosages and ignition potential. Each method has different thickness thresholds for effective response.

From this information and other relevant sources (Allen and Dale, 1996, EMSA, 2012, Spence, 2018) the surface threshold of 50g/m^2 was chosen as an average/equilibrium thickness for offshore response operations (50 g/m^2 is an average of 50% coverage of 0.1mm Bonn Agreement Code 4 – discontinuous true oil colour, or 25% coverage of 0.2mm Bonn Agreement Code 5 – continuous true oil colour which would represent small patches of thick oil or wind-rows).

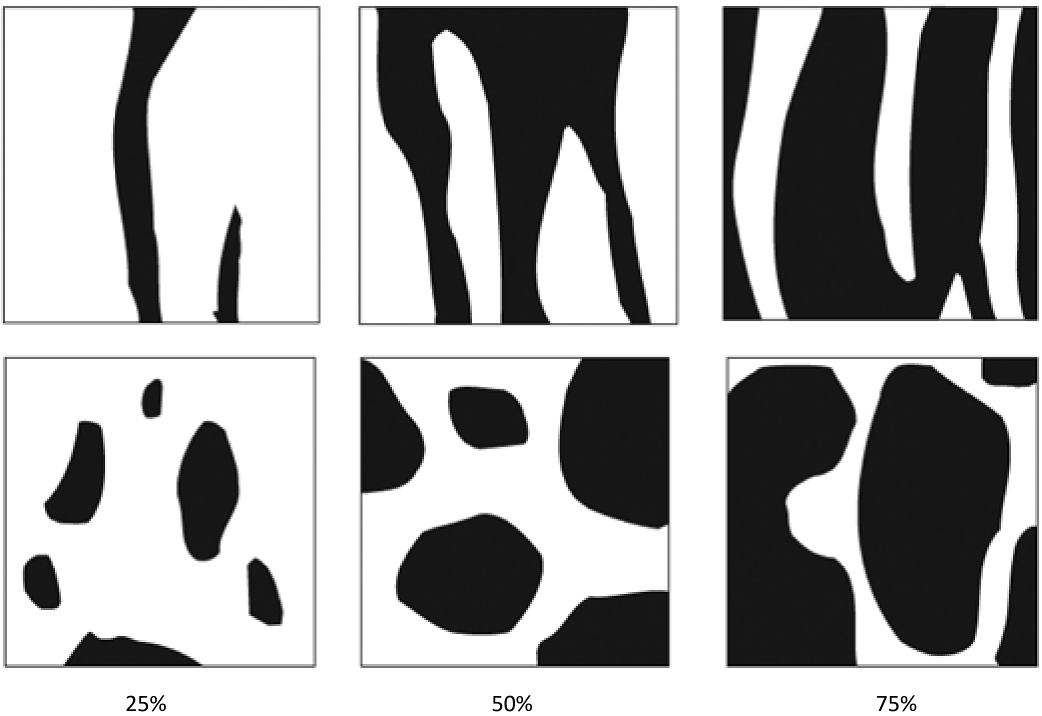

Figure 2-3: Proportion of total area coverage (AMSA, 2014)

Figure 2-4 illustrates the general relationships between on-water response techniques and slick thickness. Wind-rows, heavy oil patches and tar balls, for example, must be considered, as they influence oil encounter rates, chemical dosages and ignition potential. Each method has different thickness thresholds for effective response.

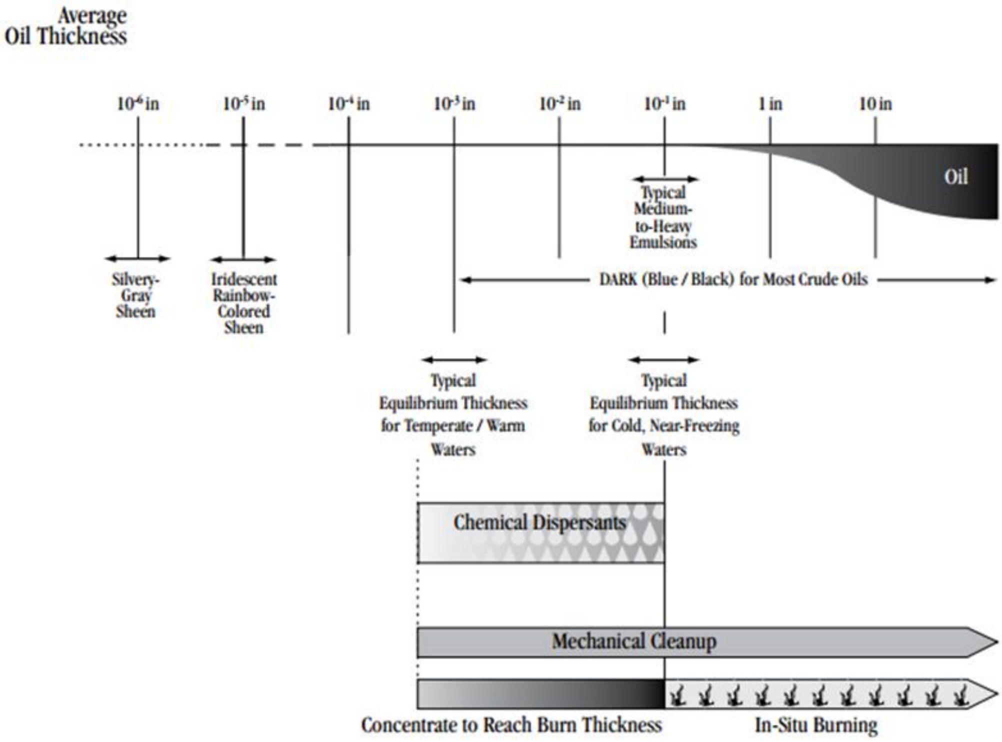

Figure 2-4: Oil thickness versus potential response options (from Allen & Dale 1996)

Wind and wave influence on the feasibility of mechanical clean-up operations and drops the effectiveness significantly because of entrainment and/or splash-over as short period waves develop beyond 2–3 ft (0.6–0.9m) in height. Waves and wind can also be limiting factors for the safe operation of vessels and aircraft.

2.3.2.3 Surface hydrocarbon viscosity

Table 2-5: Surface hydrocarbon viscosity thresholds

Surface viscosity threshold (cSt)	Description	European Maritime Safety Authority (EMSA)	Viscosity at sea temperature (cSt)
5,000*	Predicted optimum viscosity for surface dispersant operations	Generally possible to disperse	500-5,000
10,000*	Predicted maximum viscosity for effective surface dispersant operations	Sometimes possible to disperse	5,000-10,000

*Measured at sea surface temperature

Further to the required thickness for surface dispersant application and containment and recovery to be deployed effectively as outlined above, changes to viscosity will also limit the treatment of offshore response techniques. As outlined in the EMSA Manual on the Applicability of Oil Spill Dispersants (EMSA, 2012), guidance around changes to viscosity and likely effectiveness of surface dispersant application is provided.

This includes the following statements; ”It has been known for many years that it is more difficult to disperse a high viscosity oil than a low or medium viscosity oil. Laboratory testing had shown that the effectiveness of dispersants is related to oil viscosity, being highest for modern “Concentrate, UK Type 2/3” dispersants at an oil viscosity of about 1,000 or 2,000 mPa (1,000 – 2,000 cSt) and then declining to a low level with an oil viscosity of 10,000 mPa (10,000 cSt). It was considered that some generally applicable viscosity limit, such as 2,000 or 5,000 mPa (2,000 – 5,000 cSt), could be applied to all oils.”

However, modern oil spill dispersants are generally effective up to an oil viscosity of 5,000 mPa (5,000 cSt) or more, and their performance gradually decreases with increasing viscosity; oils with a viscosity of more than 10,000 are in most cases, no longer dispersible. Guidance from CEDRE (EMSA, 2012) also indicates that products with a range of 500 – 5,000 cSt at sea temperature are generally possible to disperse, while 5,000 – 10,000 cSt at sea temperature above pour point are sometimes possible to disperse, with products beyond 10,000 cSt at sea temperature below pour point are generally impossible to disperse.

To support decision making and response planning, a threshold of 10,000 cSt at sea temperature was chosen as a conservative estimate of maximum viscosity for surface dispersant spraying operations.

2.3.3 Spill modelling results

Details of the scenario and selected stochastic modelling inputs are included along with modelling results in Table 2-6.

The selected results used to represent the WCCS are based on response thresholds:

- Minimum time to commencement of hydrocarbon accumulation at any shoreline receptor (at a threshold of 100 g/m^2).
- Minimum time to floating hydrocarbon contact with the offshore edge(s) of any shoreline receptor polygon (at a threshold of 10 g/m^2).
- Maximum cumulative hydrocarbon volume accumulated at any individual shoreline receptor.
- Maximum cumulative hydrocarbon volume accumulated across all shoreline receptors contacted by accumulated hydrocarbons (including those contacted at <100 g/m^2 accumulation concentration).
- Minimum time to entrained/dissolved hydrocarbon contact with the offshore edges of any receptor polygon (at a threshold of 500 ppb).

The volumes as presented in Table 2-6 are the worst case volumes resulting from the selected stochastic modelling and have been used to determine appropriate level of response.

As noted, the modelled volume selected (550 m^3) is double the volume of the WA-49-L Gemtree Anchor Hold Testing marine diesel scenario volume (275m^3) and thus it is concluded that thresholds would be unlikely to be met for the actual scenario for this PAP.

Table 2-6: Worst case credible scenario modelling results

Response parameter	Modelled result MEE-01 Marine diesel release caused by marine vessel separation
Maximum continuous liquid hydrocarbon release rate and duration	Instantaneous surface release of 275 m^3 marine diesel.
Maximum residual surface hydrocarbon after weathering	13.75 m^3
Modelling results	
Minimum time to commencement of hydrocarbon accumulation at any shoreline receptor (at a threshold of 100 g/m^2)	No contact at threshold
Minimum time to floating hydrocarbon contact with the offshore edge(s) of any shoreline receptor polygon (at a threshold of 10 g/m^2)	5 hours at Montebello Marine Park
Maximum cumulative hydrocarbon volume accumulated at any individual shoreline receptor	No contact at threshold
Maximum cumulative hydrocarbon volume accumulated across all shoreline receptors contacted by accumulated hydrocarbons (including those contacted at <100 g/m^2 accumulation concentration)	No contact at threshold
Minimum time to entrained/dissolved hydrocarbon contact with the offshore edges of any receptor polygon (at a threshold of 500 ppb)	5 hours at Montebello Marine Park

The selected model shows that spreading and weathering of the surface oil occurs rapidly due to the loss of light, volatile components and the spreading will reduce the effectiveness and available surface area for containment and recovery and surface dispersant operations as shown in the figure below.

Response operations cannot be implemented if the safety of response personnel cannot be guaranteed. Safety circumstances that limit the execution of this control measure include volatile concentrations of marine diesel in the atmosphere, high winds (>20 knots), waves and/or sea states (>1.5m waves) and high ambient *temperatures.*

3 IDENTIFY RESPONSE PROTECTION AREAS

In a response, operational monitoring programs – including trajectory modelling and vessel/aerial observations – would be used to predict RPAs that may be impacted. For the purposes of planning and appropriately scaling a response, modelling has been used to identify RPAs as outlined below in Figure 3-1.

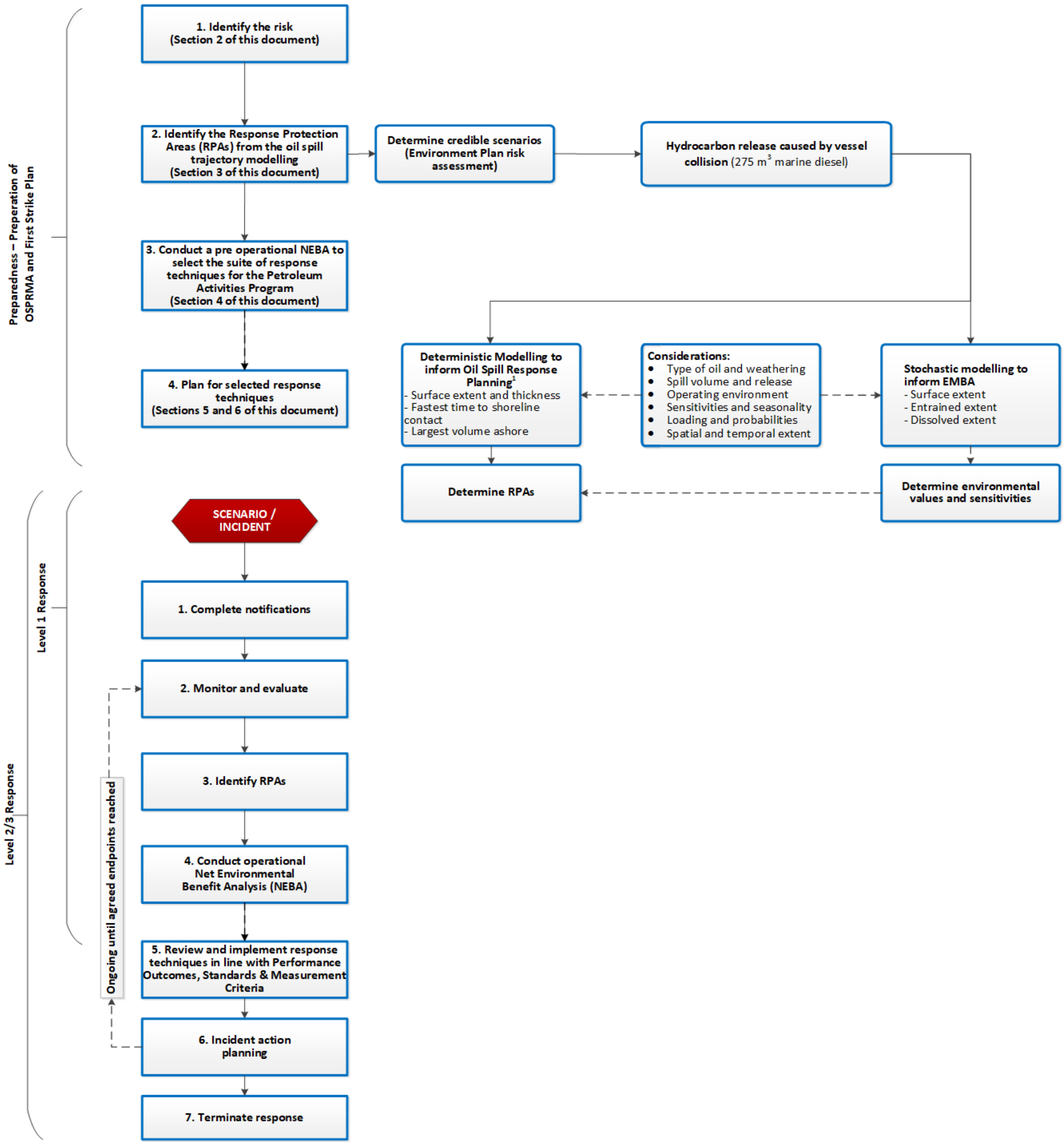

Figure 3-1: Identify Response Protection Areas (RPAs) flowchart

3.1 Identified sensitive receptor locations

Section 6 of the EP includes the list of sensitive receptor locations that have been identified by stochastic modelling as meeting the requirements outlined below:

- Receptors with the potential to incur surface, entrained or shoreline accumulation contact above environmental impact thresholds
- Receptors within the EMBA which meet the following:
  - a number of priority protection criteria/categories

- International Union for Conservation of Nature (IUCN) marine protected area categories
- high conservation value habitat and species
- important socio-economic/heritage value.

3.2 Response Protection Areas (RPAs)

RPAs are selected on the basis of their environmental (ecological, social, economic, cultural and heritage) values and sensitivities and considering the minimum response thresholds (detailed in Section 2.3.2) together with the ability to conduct a response.

Contact from floating hydrocarbons above 10 g/m^2 is predicted for the offshore edge of one receptor (Montebello Marine Park) based on the stochastic modelling selected for this PAP. Additionally, modelling shows there is no accumulation above 100 g/m^2 on any shoreline.

Deterministic modelling was consequently not undertaken due to the stochastic spill modelling only predicting contact at one offshore receptor at the response threshold and no shoreline contact above the response thresholds. As the modelling selected is based on a volume of 550 m^3, which is double the volume of the WA-49-L Gemtree Anchor Hold Testing marine diesel scenario volume (275 m^3), it was thus concluded that thresholds would be unlikely to be met for the actual scenario for this PAP. During a real spill event, however, operational monitoring techniques (OM01, OM02, OM03, OM04 and OM05) would be deployed from the outset of the spill to track the spill trajectory and deduce if any RPAs are at risk of impact. TRPs will be drafted in advance for any RPAs with a contact time of <14 days.

Any additional sensitive receptors are presented in the existing environment description (Section 4 of the EP) and impact assessment section (Section 6 of the EP) for the spill scenario. The pre-operational NEBA (Section 4) considers the results from the stochastic modelling to ensure all feasible response techniques are considered in the planning phase, therefore additional receptors are also included in the pre-operational NEBA. Although Stochastic modelling showed no impact above threshold, RPAs have been selected that are within proximity to the PAP and these have been used for completing the NEBA and to support response planning.

Table 3-1: Response Protection Areas (RPAs) from stochastic modelling

Areas of coastline contacted	Conservation status	IUCN protection category	Minimum time to shoreline contact (above 100g/m^2) in days [4]	Maximum shoreline accumulation (above 100g/m^2) in m^3 [5]
Ningaloo Coast (North/North West Cape, Middle and South) (WHA, and State Marine Park)	State Marine Park Australian Marine Park World Heritage Area	IUCN IV – Recreational Use Zone (AMP) IUCN II – Marine National Park Zone	No contact at threshold	No contact at threshold
Montebello Islands and State Marine Park	State Marine Park Australian Marine Park	IUCN IA – Strict Nature Reserve IUCN VI – Multiple Use Zone IUCN II and IV – Recreational Use Zone IUCN II – Marine National Park Zone	No contact at threshold	No contact at threshold
Barrow Island	Barrow Island Marine Park Barrow Island Marine Management Area	IUCN IA – Strict Nature Reserve IUCN VI – Multiple Use Zone IUCN IV – Recreational Use Zone	No contact at threshold	No contact at threshold
Lowendal Islands	State Marine Park	IUCN VI – Multiple Use Zone	No contact at threshold	No contact at threshold
Argo-Rowley Terrace CMR	Australian Marine Park	IUCN II – Marine National Park Zone IUCN VI – Multiple Use Zone	No contact at threshold	No contact at threshold
Muiron Islands WHA & SMP	Muiron Islands Marine	IUCN IA – Strict Nature	No contact at threshold	No contact at threshold

[4] This volume and time represent the first time to contact on defined shoreline polygon and the maximum volume ashore for that 24 hour period.
[5] This volume and time represent the maximum volume ashore on defined shoreline polygon for any 24 hour time period

Areas of coastline contacted	Conservation status	IUCN protection category	Minimum time to shoreline contact (above $100g/m^2$) in days [(4)]	Maximum shoreline accumulation (above $100g/m^2$) in m^3 [(5)]
	Management Area	Reserve IUCN VI – Multiple Use Zone		
Rankin Bank	N/A	N/A	No contact at threshold	No contact at threshold
Glomar Shoals	Key Ecological Feature	N/A	No contact at threshold	No contact at threshold

4 NET ENVIRONMENTAL BENEFIT ANALYSIS

A Net Environmental Benefit Analysis (NEBA) is a structured process to consider which response techniques are likely to provide the greatest net environmental benefit.

The NEBA process typically involves four key steps outlined in Figure 4-1: evaluate data, predict outcomes, balance trade-offs, and select response options. These steps are followed in the planning/preparedness process and would also be followed in a response.

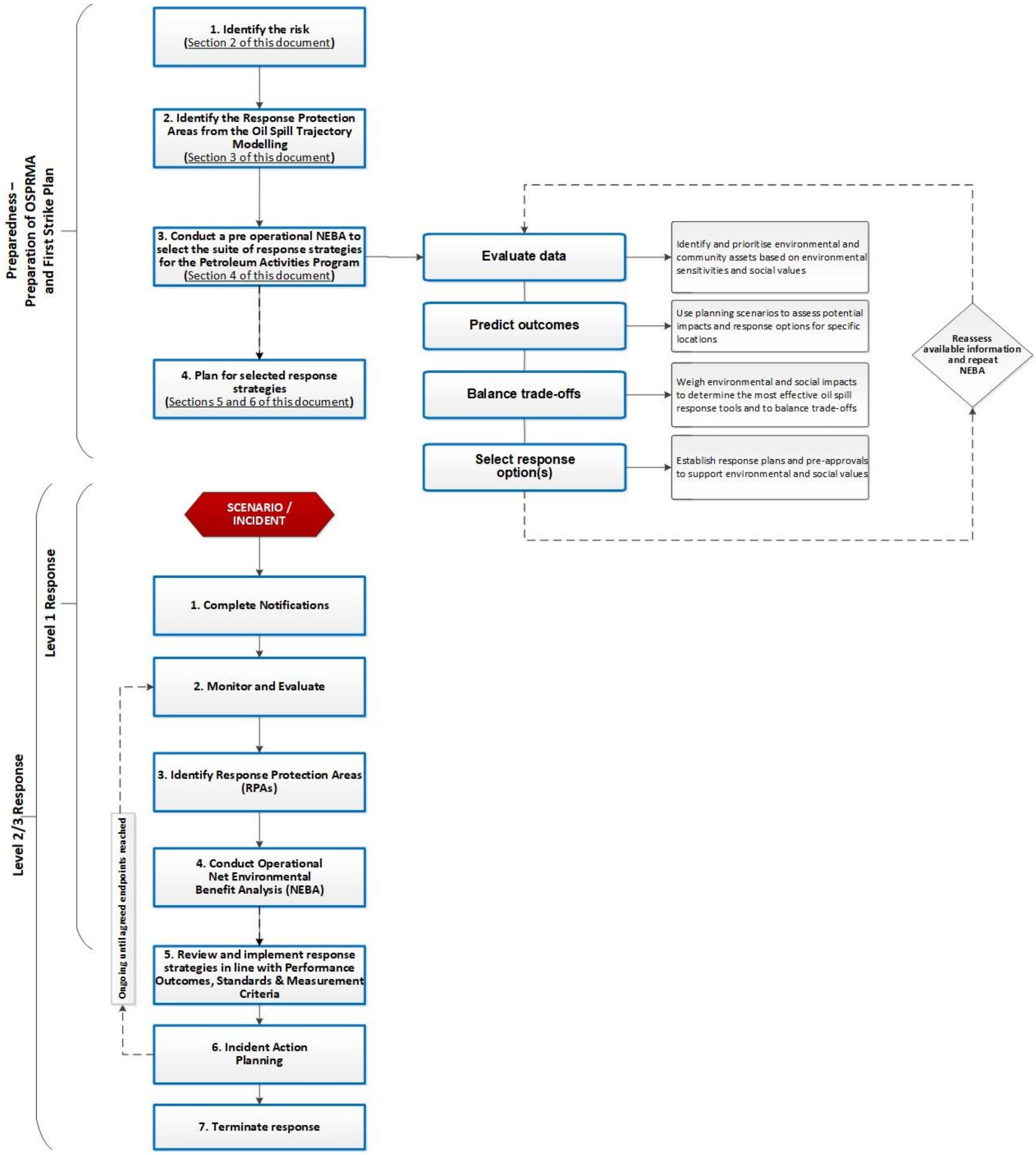

Figure 4-1: Net Environmental Benefit Analysis (NEBA) flowchart

4.1 Pre-operational / Strategic NEBA

The pre-operational NEBA identifies positive and negative impacts to sensitive receptors from implementing the response techniques. Feasibility is considered by assessing the receptors potentially impacted above response thresholds (Section 2.3.2) and the surface concentrations (Section 2.3.2.2) from the deterministic modelling.

Completing a pre-operational NEBA is a key response planning control that reduces the environmental risks and impacts of implementing the selected response techniques. Comprehensive details of the pre-operational NEBA for this PAP are contained in ANNEX A: Net Environmental Benefit Analysis detailed outcomes.

4.2 Stage 1: Evaluate data

Woodside identifies and prioritises environmental and community assets based on environmental sensitivities and social values, informed through the use of trajectory modelling. Interpretation of stochastic oil spill modelling determines the EMBA for the release, which defines the spatial area that may be potentially impacted by the PAP activities.

4.2.1 Define the scenario(s)

Woodside uses scenarios identified from the risk assessment in the EP to assess potential impacts and response options for specific locations. The overall WCCS is then selected for deterministic modelling and is used for this pre-operational NEBA. Outlier locations with potential environmental impacts, selected from the stochastic modelling may also be included for assessment. Response thresholds and deterministic modelling are then used to assess the feasibility/effectiveness and scale of the response.

Table 4-1: Scenario summary information (WCCS)

Scenario summary information (MEE-01)	
Scenario	Marine diesel release caused by vessel collision
Location	Lat: 20° 02’ 06” S Long: 115° 06’ 32” E
Oil Type	Marine diesel
Fate and Weathering	6% of the oil mass should evaporate within the first 12 hours (BP < 180 °C); 35% should evaporate within the first 24 hours (180 °C < BP < 265 °C); 54% should evaporate over several days (265 °C < BP < 380 °C).
Volume and duration of release	275 m^3 (instantaneous)

4.2.1.1 Hydrocarbon characteristics

Marine diesel oil is typically classed as an ITOPF Group I/II oil. It is a mixture of volatile and persistent hydrocarbons with low proportions of highly volatile and residual components. The fate and effects are detailed in Section 2.2.1.

Table 4-2: Oil fate, behaviour and impacts

Stochastic modelling results for WCCS MEE-01	
Minimum time to shoreline contact (above 100 g/m^2)	No contact at threshold
Largest volume ashore at any single RPA (above 100 g/m^2)	No contact at threshold
Largest total shoreline accumulation (above 100g/m^2)	No contact at threshold

4.2.2 Determining potential response options

The available response techniques for a vessel-based diesel spill based on current technology can be summarised under the following headings:

- monitor and evaluate (including operational monitoring)
- source control via vessel SOPEP
- surface dispersant application:
  - aerial dispersant application
  - vessel dispersant application
- mechanical dispersion
- in-situ burning
- containment and recovery
- shoreline protection and deflection:
  - protection
  - deflection
- shoreline clean-up:
  - phase 1 – mechanical clean-up
  - phase 2 – manual clean-up
  - phase 3 – final polishing
- oiled wildlife response

Support functions may include:

- waste management
- scientific monitoring

An assessment of which response options are feasible for the scenarios is included below in Table 4-3. These options are evaluated against each scenario's parameters including oil type, volume and characteristics, prevailing weather conditions, logistical support, and resource availability to determine their deployment feasibility.

A shortlist of the feasible response options is then carried forward for the ALARP assessment with a justification for the exclusion of other response techniques included in Section 4.2.3. This assessment will typically result in a range of available options that are deployed at different areas (at-source, offshore, nearshore and onshore) and times through the response. The NEBA process assists in prioritising which options to use where, when and timings throughout the response.

Table 4-3: Response technique evaluation – surface release of marine diesel

Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
Hydrocarbon: Marine Diesel				
Monitor and evaluate	Will be effective in tracking the location of the spill, predicting potential impacts and triggering further monitoring and response techniques as required. Monitoring techniques include: • OM01 Predictive modelling of hydrocarbons – used throughout spill. 'Ground-truthed' using the outputs of all other monitoring techniques. • OM02 Surveillance and reconnaissance to detect hydrocarbons and resources at risk – from outset of spill. • OM03 Monitoring of hydrocarbon presence, properties, behaviour and weathering in water – from outset of spill. • OM04 Pre-emptive assessment of sensitive receptors at risk – triggered once OM01, OM02 and OM03 inform likely RPAs at risk. • OM05 Shoreline assessment – once OM02, OM03 and OM04 inform if any RPAs have been impacted.	Monitoring of a marine diesel spill is a feasible response technique and outputs will be used to guide decision making on the use of other monitoring/response techniques and providing information to regulatory agencies including AMSA and WA DoT. Practicable techniques that could be used for this scenario include predictive modelling (OM01), surveillance and reconnaissance OM02) and monitoring of hydrocarbon presence in water (OM03). Modelling does not predict impact of any shoreline receptors at threshold, however, pre-emptive assessment of sensitive receptors at risk (OM04) and monitoring of contaminated resources (OM05) would be utilised if any sensitive shoreline receptors are deemed to be at risk of impact.	**Yes**	Monitoring the spill will be necessary to: • validate trajectory and weathering models • determine the behaviour of the oil in water • determine the location and state of the slick • provide forecasts of spill trajectory • determine appropriate response techniques • determine effectiveness of response techniques • confirm impact pathways to receptors • provide regulatory agencies with required information.
Source control via vessel SOPEP	Controlling the spill of diesel at source would be the most effective way to limit the quantity of hydrocarbon entering the marine environment.	A spill of diesel from a vessel collision will be instantaneous and source control will be limited to what the vessel or facility can safely achieve whilst responding to the incident.	**Yes**	Ability to stop the spill at source will be dependent upon the specific spill circumstances and whether or not it is safe for response personnel to access/isolate the source of the spill.
Surface dispersant application	Dispersants are not considered effective when applied on thin surface films such as marine diesel as the dispersant droplets tend to pass through the surface films without binding to the hydrocarbon resulting in the unnecessary addition of chemicals to the marine environment	Marine diesel is prone to rapid spreading and evaporation and is not suitable for surface dispersant application. Furthermore, the volatile nature of marine diesel is also likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon thus this response technique is deemed inappropriate.	**No**	The application of dispersant to marine diesel is unnecessary as the diesel will rapidly evaporate and would thus unnecessarily introduce additional chemical substances to the marine environment. The additional entrainment would also increase exposure of subsea species and habitats to hydrocarbons.
Containment and recovery	Containment and recovery has an effective recovery rate of 5-10% when a hydrocarbon encounter rate of 25-50% is achieved at BAOAC 4 and 5 with a 50-100% coverage of 100 g/m^2 to 200 g/m^2.	Marine diesel is prone to rapid spreading and evaporation and is deemed unsuitable for effective containment and recovery operations, particularly with the predicted residue of 13.75 m^3. Furthermore, the volatile nature of marine diesel is also likely to lead to unsafe conditions in the vicinity of the hydrocarbon thus this response technique is deemed inappropriate.	**No**	Containment and recovery would be an inappropriate response technique for a spill of marine diesel. In addition to the safety issues, most of the spilled diesel would have been subject to rapid evaporation prior to the commencement of containment and recovery operations.
In-situ burning	In-situ burning is only effective where minimum slick thickness can be achieved.	Use of in-situ burning as a response technique for marine diesel is unfeasible as the minimum slick thickness cannot be attained due to rapid spreading. In addition, there is a limited window of opportunity in which this technique can be applied (prior to evaporation of the volatiles) which is unlikely to be achieved. Furthermore, entering a volatile environment to undertake this technique would be unsafe for response personnel and its used would unnecessarily cause an increase the release of atmospheric pollutants.	**No**	Diesel characteristics are not appropriate for the use of in-situ burning and would unnecessarily cause an increase the release of atmospheric pollutants.
Mechanical dispersion	Mechanical dispersion involves the use of a vessel's prop wash and/or fire hose to target surface hydrocarbons to achieve dispersion into the water column. However, this technique is of limited benefit in an open ocean environment where wind and wave action are likely to deliver similar advantages.	Although the technique is feasible, highly volatile hydrocarbons are likely to weather, spread and evaporate quickly. The volatile nature of the oil likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon. Additionally, any vessel used for mechanical dispersion activities would be contaminated by the hydrocarbon and could potentially cause secondary contamination of unimpacted areas when exiting the spill area. The decontamination of a vessel used for mechanical dispersion activities would result in additional quantities of oily waste requiring appropriate handling and treatment.	No	Given the limited benefit of mechanical dispersion over natural wind and wave action, secondary contamination and waste issues, and the associated safety risk of implementing the response for this activity, this strategy is deemed unsuitable.
Shoreline protection and deflection	Shoreline protection and deflection can be effective at preventing contamination of at-risk areas.	A marine diesel spill would be prone to rapid spreading and evaporation and the WA-49-L Gemtree Anchor Hold Testing	**No**	In addition to safety issues and the rapid spreading and evaporation of the diesel, the modelling undertaken predicts that no shoreline

Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
Hydrocarbon: Marine Diesel				
		modelling predicts that no shoreline receptors will be contacted at threshold. Furthermore, the volatile nature of marine diesel is also likely to lead to unsafe conditions in the vicinity of the hydrocarbon. Monitor and evaluate will, however, be deployed from the outset of a spill to track the spill location and fate in real-time.		receptors would be contacted by floating oil concentrations at any of the assessed thresholds.
Shoreline clean-up	Shoreline clean-up is an effective means of hydrocarbon removal from contaminated shorelines where coverage is at an optimum level of 250 g/m^2.	A marine diesel spill would be prone to rapid spreading and evaporation and the WA-49-L Gemtree Anchor Hold Testing modelling predicts that no shoreline receptors will be contacted at threshold - any minor contact is significantly below any threshold concentration that would allow a response to be feasible. Furthermore, the volatile nature of marine diesel is also likely to lead to unsafe conditions in the vicinity of the hydrocarbon. Monitor and evaluate will, however, be deployed from the outset of a spill to track the spill location and fate in real-time.	**No**	In addition to safety issues, the modelling undertaken predicts that no shoreline receptors would be contacted by floating oil concentrations at a recoverable threshold and a spill of marine diesel is unlikely to accumulate at concentrations appropriate for shoreline clean-up techniques.
Oiled wildlife response	Oiled wildlife response is an effective response technique for reducing the overall impact of a spill on wildlife. This is mostly achieved through hazing to prevent additional wildlife from being contaminated and through rehabilitation of those already subject to contamination.	Due to the likely volatile atmospheric conditions surrounding a diesel spill, response options may be limited to hazing to ensure the safety of response personnel. The modelling undertaken predicts that no sensitive areas will be impacted thus it is unlikely that this technique would be required. Monitor and evaluate will, however, be deployed from the outset of a spill to track the spill location and fate in real-time. Thus, in the event that wildlife are at risk of contamination, oiled wildlife response will be undertaken in accordance with the Wildlife Response Operational Plan as and where required. In addition, any rehabilitation could only be undertaken by trained specialists.	**Yes**	The modelling undertaken predicts that no sensitive areas will be impacted thus it is unlikely that this technique would be required. However, in the event that wildlife are at risk of contamination, oiled wildlife response will be undertaken as and where required.

4.2.3 Exclusion of response techniques

4.2.3.1 Surface dispersant application

Dispersants are not considered effective when applied on thin surface films such as diesel, as the dispersant droplets tend to pass through the surface films without binding to the hydrocarbon, making it unsuitable for effective treatment and unnecessarily adding chemicals to the marine environment. A marine diesel spill is also expected to dissipate rapidly on the surface and become entrained due to local metocean conditions.

4.2.3.2 Containment and recovery

Rapid spreading and thinning of diesel would result in a marginal reduction in diesel on the surface. Diesel would evaporate and spread too thinly to allow this response technique to be effective. Furthermore, the volatile nature of marine diesel is also likely to lead to unsafe conditions in the vicinity of the hydrocarbon.

4.2.3.3 In situ burning

Diesel is not suitable for in situ burning due to rapid evaporation, minimum thickness requirements and window of opportunity. Furthermore, the volatile nature of marine diesel is also likely to lead to unsafe conditions in the vicinity of the hydrocarbon.

4.2.3.4 Mechanical dispersion

Mechanical dispersion involves the use of a vessel’s propeller wash and/or fire hose to target surface hydrocarbons to achieve dispersion into the water column. However, this technique is of limited benefit in an open ocean environment where wind and wave action are likely to deliver similar advantages. Additionally, any vessel used for mechanical dispersion activities would be contaminated by the hydrocarbon and could potentially cause secondary contamination of unimpacted areas when exiting the spill area. The decontamination of a vessel used for mechanical dispersion activities would result in additional quantities of oily waste requiring appropriate handling and treatment. Furthermore, the volatile nature of marine diesel is also likely to lead to unsafe conditions in the vicinity of the hydrocarbon.

4.2.3.5 Shoreline protection and deflection

The modelling undertaken predicts that a diesel spill would be prone to rapid spreading and evaporation with no shoreline contact at threshold. Furthermore, the volatile nature of marine diesel is also likely to lead to unsafe conditions in the vicinity of the hydrocarbon.

4.2.3.6 Shoreline clean-up

The modelling undertaken predicts that a diesel spill would be prone to rapid spreading and evaporation with no shoreline contact at threshold. Furthermore, the volatile nature of marine diesel is also likely to lead to unsafe conditions in the vicinity of the hydrocarbon.

4.3 Stage 2: Predict outcomes

Woodside uses planning scenarios to assess potential impacts and response options for specific locations. Locations with potential environmental impacts, selected from the stochastic modelling are included for assessment. Response thresholds and deterministic modelling are then used to assess the feasibility/effectiveness of a response.

4.4 Stage 3: Balance trade-offs

Woodside considers environmental impacts and response effectiveness/feasibility to determine the most effective oil spill response tools and balance trade-offs using an automated NEBA tool. The tool considers potential benefits and impacts associated with a response at sensitive receptors and then considers the effectiveness/feasibility of the response to select the response techniques carried forward to the ALARP assessment (ANNEX A: Net Environmental Benefit Analysis detailed outcomes).

4.5 Stage 4: Select Best Response Options

To select the response technique, all the other stages in the NEBA process are considered and used to establish response plans and any pre-approvals to support protection of identified environmental and social values.

The response techniques implemented may vary according to a particular spill. The hydrocarbon type released and the sensitivities of the receptors (both ecological and socio-economic) may influence the response. The pre-operational NEBA broadly evaluates each response technique and supports decisions on whether they are feasible and of net environmental benefit. Response techniques that are not feasible or beneficial are rejected at this stage and not progressed to planning.

Further risks and impacts from implementing these selected response options are outlined in Section 7.

Table 4-4: Selection and prioritisation of response techniques

Response planning scenario	Key characteristics for response planning (times are minimum times to contact for first receptor and/or shoreline contacted above response threshold)	Feasibility of response techniques									Outline response technique
		Monitor and evaluate	Source control via vessel SOPEP	Surface dispersant application	Mechanical dispersion	In-situ burning	Containment and recovery	Shoreline protection and deflection	Shoreline cleanup	Oiled wildlife response	
MEE-01: Instantaneous release of up to 275 m^3 marine diesel from a vessel collision (residual component of 13.75 m^3).	No shoreline contact at threshold Fastest time for floating oil at an offshore receptor >50 g/m^2: Montebello Marine Park 5 hours	Yes	Yes	No	No	No	No	No	No	Yes	Monitor and evaluate. Initiate source control via SOPEP if feasible. Plan for oiled wildlife response and implement if oiled wildlife is observed.

From the NEBA undertaken on the WCCS identified (release of marine diesel from a vessel collision – MEE-01), the recommended response techniques are;

- Monitor and evaluate
- Source control via SOPEP on the vessel
- Oiled wildlife response

Support functions may include:

- Waste management
- Scientific monitoring programs

5 HYDROCARBON SPILL ALARP PROCESS

Woodside's hydrocarbon spill ALARP process is aligned with guidance provided by NOPSEMA in *Guideline N-04750-GL1687* (2016) and is set out in the 'Woodside Oil Spill Preparedness and Response Mitigation Assessment (OSPRMA) Guidelines'.

From the identified response planning need and pre-operational NEBA, Woodside conducts a structured, semi-quantitative hydrocarbon spill process which has the following steps:

1. considers the Response Planning Need identified in terms of surface area (km^2) and available surface hydrocarbon volumes (m^3) against existing Woodside capability
2. considers alternative, additional, and improved options for each response technique/control measure by providing an initial and, if required, detailed evaluation of:
    - predicted cost associated with adopting the control measure
    - predicted change/environmental benefit
    - predicted effectiveness/feasibility of the control measure.
3. evaluates the risks and impacts of implementing the proposed response techniques, and any further control measures with associated environmental performance to manage these additional risks and impacts.

Woodside considers the risks and impacts from a hydrocarbon spill to have been reduced to ALARP when:

1. a structured process for identifying and considering alternative, additional, and improved options has been completed for each selected response technique
2. the analysis of alternate, additional, and improved control measures meets one of the following criteria:
    - all identified, reasonably practicable control measures have been adopted
    - no identified reasonably practicable additional, alternative and/or improved control measures would provide further overall increased proportionate environmental benefit; or
    - no reasonably practical additional, alternative, and/or improved control measures have been identified.
3. where an alternative, additional and/or improved control measure is adopted, a measurable level of environmental performance has been assigned
4. higher order impacts/ risks have received more comprehensive alternative, additional, and improved control measure evaluations and do not just compare the cost of the adopted control measures to the costs of an extreme or clearly unreasonable control measure
5. cumulative effects have been analysed when considered in combination across the whole activity.

The response technique selection is based on the risk assessment conducted in the EP. The risk assessment identifies the type of oil, volume of release, duration of release, predicted fate, weathering and the EMBA (along with other requirements such as time to impact and predicted volumes ashore). Modelling is then used to inform the NEBA and the prioritisation of suitable response options. The scale of the response techniques selected in the pre-operational NEBA is informed through the assessment of results from deterministic modelling.

For the purpose of the ALARP assessment, the following terms and definitions have been used:

- Response techniques are considered the control measures that reduce consequences from hydrocarbon spill events. The terms 'response technique' and 'control measure' are used interchangeably.
- Cost is defined as the time, effort and/or trouble taken in financial, safety, design/storage/installation, capital/lease, and/or operations/maintenance terms to adopt a control measure.

- Where the predicted change to environmental impact is compared against standard environmental values and sensitivities impacts using positive or negative criteria from the NEBA Impact Ranking Classification Guidance in ANNEX A: Net Environmental Benefit Analysis detailed outcomes.

5.1 Monitor and Evaluate (including operational monitoring)

Monitor and evaluate includes the gathering and evaluation of data to inform the oil spill response planning and operations. It includes fate and trajectory modelling, spill tracking, weather updates and field observations. This response option is deployed in some capacity for every event.

The table below provides the operational monitoring plans that support the successful execution of this response technique.

Table 5-1: Description of supporting operational monitoring plans

ID	Title
OM01	Predictive modelling of hydrocarbons to assess resources at risk
OM02	Surveillance and reconnaissance to detect hydrocarbons and resources at risk
OM03	Monitoring of hydrocarbon presence, properties, behaviour and weathering in water
OM04	Pre-emptive assessment of sensitive receptors at risk
OM05	Shoreline assessment

Woodside maintains an *Operational Monitoring Operational Plan*. If shoreline contact is predicted, Response Protection Areas (RPAs) will be identified and assessed before contact. If shorelines are contacted, a shoreline assessment survey will be completed to guide effective shoreline clean-up operations. This plan includes the process for the IMT to mobilise resources depending on the nature and scale of the spill.

The proximity of Exmouth, Onslow and Dampier to the spill event location means that multiple logistical options are available to monitor the spill in relatively short timeframes. The primary mobilisation base for initial monitoring activities would be Dampier. However, in the event of an extended spill with potential to impact receptors further afield, monitoring activities may also be mobilised from Exmouth, Onslow and Broome.

5.1.1 Response need based on predicted consequence parameters

The following statements identify the key parameters upon which a response need can be based:

- Operational monitoring will be undertaken from the outset of a spill. This is needed to assess the nature of the spill and track its location. The data collected from the operational monitoring will inform the need for any additional operational monitoring, deployment of response techniques and may assist post-spill scientific monitoring. It also informs when the spill has entered State Waters and control of the incident passes to WA DoT.
- No shoreline contact from floating oil is predicted above threshold for a marine diesel spill. The time to contact for floating oil at the offshore edge of a receptor is 5 hours at Montebello Marine Park. The time to contact for entrained hydrocarbons greater than 500 ppb is 5 hours at Montebello Marine Park (752 ppb) and 7.2 days at Gascoyne Marine Park (614 ppb).
- Arrangements for support organisations who provide specialist services or resources should be tested regularly.
- Plans, procedures and support documents need to be in place for Operational and Support functions. These should be reviewed and updated regularly.
- The duration of the spill would be instantaneous with response operations extending until the hydrocarbon discharge has ceased, surface hydrocarbons are no longer visible, and no additional response or clean-up of wildlife or habitats is predicted.
- The location, trajectory and fate of the spill will be verified by real-time spill tracking via modelling, direct observation and remote sensing (OM01, OM02, OM03, OM04 and OM05).

5.1.2 Environmental performance based on need

Table 5-2: Environmental Performance – Monitor and Evaluate

Environmental Performance Outcome		To gather information from multiple sources to establish an accurate common operating picture as soon as possible and predict the fate and behaviour of the spill to validate planning assumptions and adjust response plans as appropriate to the scenario.		
Control measure		Performance Standard		Measurement Criteria (Section 5.7)
1	Oil spill trajectory modelling	1.1	Initial modelling available within 6 hours using the Rapid Assessment Tool.	1, 3B, 3C, 4
		1.2	Detailed modelling available within 4 hours of APASA receiving information from Woodside.	
		1.3	Detailed modelling service available for the duration of the incident upon contract activation.	
2	Tracking buoy	2.1	Tracking buoy located on facility/vessel and ready for deployment 24/7.	1, 3A, 3C, 4
		2.2	Deploy tracking buoy from facility within 2 hours as per the First Strike Plan.	1, 3A, 3B, 4
		2.3	Contract in place with service provider to allow data from tracking buoy to be received 24/7 and processed.	1, 3B, 3C, 4
		2.4	Data received to be uploaded into Woodside COP daily to improve the accuracy of other monitor and evaluate strategies.	1, 3B, 4
3	Satellite imagery	3.1	Contract in place with 3rd party provider to enable access and analysis of satellite imagery. Imagery source/type requested on activation of service.	1, 3C, 4
		3.2	3rd party provider will confirm availability of an initial acquisition within 2 hours.	1, 3B, 3C, 4
		3.3	First image received with 24 hours of Woodside confirming to 3rd party provider its acceptance of the proposed acquisition plan.	1
		3.4	3rd party provider to submit report to Woodside per image. Report is to include a polygon of any possible or identified slick(s) with metadata.	1
		3.5	Data received to be uploaded into Woodside COP daily to improve accuracy of other monitor and evaluate strategies.	1, 3B, 4
		3.6	Satellite Imagery services available and employed during response.	1, 3C, 4
4	Aerial surveillance	4.1	2 trained aerial observers available to be deployed by day 1 from resource pool.	1, 2, 3B, 3C, 4
		4.2	1 aircraft available for 2 sorties per day, available for the duration of the response from day 1.	1, 3C, 4
		4.3	Observer to compile report during flight as per First Strike plan. Observers report available to the IMT within 2 hours of landing after each sortie.	1, 2, 3B, 4
		4.4	Unmanned Aerial Vehicles/Systems (UAV/UASs) to support Shoreline Clean-up Assessment Technique (SCAT), containment and recovery and surface dispersal and pre-emptive assessments as contingency if required.	1, 2
5	Hydrocarbon detections in water	5.1	Activate 3rd party service provider as per First Strike plan. Deploy resources within 3 days: • 3 specialists in water quality monitoring • 2 monitoring systems and ancillaries • 1 vessel for deploying the monitoring systems with a dedicated winch, A-frame or Hiab and ancillaries to deploy the equipment.	1, 2, 3C, 3D, 4
		5.2	Water monitoring services available and employed during response.	1, 3C, 4
		5.3	Preliminary results of water sample as per contractor's implementation plan within 7 days of receipt of samples at the accredited lab.	
		5.4	Daily fluorometry reports as per service provider's implementation plan will be provided to IMT to validate modelling and monitor presence/absence of entrained hydrocarbons.	

Environmental Performance Outcome		To gather information from multiple sources to establish an accurate common operating picture as soon as possible and predict the fate and behaviour of the spill to validate planning assumptions and adjust response plans as appropriate to the scenario.		
Control measure		Performance Standard		Measurement Criteria (Section 5.7)
		5.5	Use of Autonomous Underwater Vehicles (AUVs) for hydrocarbon presence and detection may be used as a contingency if the operational SIMA confirms conventional methods are unsafe or not possible.	1, 2, 3C, 4
6	Pre-emptive assessment of sensitive receptors	6.1	Within 2 days, in agreement with WA DoT (for Level 2/3 incidents), deployment of 2 specialists from resource pool in establishing the status of sensitive receptors with predicted impacts.	1, 2, 3B, 3C, 4
		6.2	Daily reports provided to IMT on the status of the receptors to prioritise Response Protection Areas (RPAs) and maximise effective utilisation of resources.	1, 3B, 4
7	Shoreline assessment	7.1	Within 2 days, in agreement with WA DoT (for Level 2/3 incidents), deployment of 1 specialist(s) in SCAT from resource pool for each of the Response Protection Areas (RPAs) with predicted impacts.	1, 2, 3B, 3C, 4
		7.2	SCAT reports provided to IMT daily detailing the assessed areas to maximise effective utilisation of resources.	1, 3B, 4
		7.3	Shoreline access routes with the least environmental impact identified will be selected by a specialist in SCAT operations.	1
8	Management of Environmental Impact of the response risks	8.1	If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic habitats. Where existing fixed anchoring points are not available, locations will be selected to minimise impact to nearshore benthic environments with a preference for areas of sandy seabed where they can be identified.	1
		8.2	Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines.	

The control measures and capability of Woodside and its third-party service providers are shown to support Monitor and Evaluate activities up to and including the identified WCCS. This is demonstrated by the following:

- Woodside has a documented, structured and tested capability for Monitor and Evaluate operations including internal trajectory modelling capabilities, tracking buoys located offshore and contracted aerial observation platforms with access to trained observers.
- Woodside and its third-party service providers ensure there is sufficient capability for the duration of the response.
- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures. Where control measures have been selected and implemented, they are included in Section 6.1.
- The health and safety, financial, capital and operations/maintenance costs of implementing the alternative, additional or improved control measures identified and not carried forward are considered clearly disproportionate to the environmental benefit gained and/or not reasonably practicable for this PAP.
- The Monitor and Evaluate capability outlined in this section is part of the response developed to manage potential risks and impacts associated with the scenarios to ALARP, and there are no further additional, alternative and improved control measures other than those implemented that would provide further benefit.

5.2 Source Control via Vessel SOPEP

Vessel source control will be conducted, where feasible and in accordance with MARPOL 73/78 Annex I, by the Vessel Master under the Shipboard Oil Pollution Environment Plan (SOPEP) triggered by any loss of containment from the PAP vessel.

The SOPEP provides guidance to the Master and Officers on board the vessel with respect to the extra steps to be taken when an unexpected pollution incident has occurred or is likely to occur. The SOPEP contains all information and operational instructions required by IMO Resolution MEPC.54 (32) adopted on 6 March 1992, as amended by resolution MEPC.86 (44) adopted on 13 March 2000.

Its purpose is to set in motion the necessary actions to stop or minimise oil discharge and mitigate its effects and outlines responsibilities, pollution reporting requirements, procedures and resources needed in the event of a hydrocarbon spill from vessel activities.

In the event of the WCCS vessel collision event, the vessel master may engage precautionary marine manoeuvres to avoid collision or commence pumping operations to transfer marine diesel and thus minimise the release.

5.2.1 Environmental performance based on need

Woodside has established control measures, environmental performance outcomes, performance standards and measurement criteria to be used for vessel-source oil spill response during the PAP which are detailed in Section 6 of the EP. The vessel master's roles and responsibilities are described in Section 7 of the EP.

Performance standards for the contracted PAP vessel are detailed in the vessel's specific SOPEP.

- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures. Where control measures have been selected and implemented, they are included in the vessel SOPEP.
- The health and safety, financial, capital and operations/maintenance costs of implementing alternative, additional or improved control measures are considered clearly disproportionate to the environmental benefit gained and/or not reasonably practicable for this PAP.
- The vessel source control capability outlined in the SOPEP is part of the response developed to manage potential risks and impacts associated with the scenarios to ALARP, and there are no further additional, alternative and improved control measures other than those implemented that would provide further benefit.

5.3 Oiled wildlife response

Woodside would implement a response in accordance with the *Oiled Wildlife Operational Plan*. This plan includes the process for the IMT to mobilise resources depending on the nature and scale of the spill. Oiled wildlife operations would be implemented with advice and assistance from the Oiled Wildlife Advisor from the Department of Biodivseristy, Conservation and Attractions (DBCA).

Oiled wildlife response is undertaken in accordance with the Western Australian Oiled Wildlife Response Plan to ensure it is conducted in accordance with legislative requirements under the *Animal Welfare Act 2002*.

If there is a net environmental benefit, oiled wildlife operations will be conducted 24 hours per day to reduce the time for rehabilitation and release of oiled wildlife. Hazing and pre-emptive capture techniques to keep non-oiled animals away from contaminated habitat in instances where it is deemed appropriate will be conducted in accordance with the Western Australian Oiled Wildlife Response Plan, specifically vessels used in hazing/pre-emptive capture will approach wildlife at slow speeds to ensure animals are not directed towards the oil and deterrence/hazing and pre-emptive capture will only be conducted if Woodside has licensed authority from DBCA and approval from the Incident Controller.

Shoreline access will be considered as part of the operational NEBA. Vehicular access would be restricted on dunes, turtle nesting beaches and in mangroves. Woodside retains specialist personnel to support and manage oiled wildlife operations, including trained and competent responders in Exmouth and Dampier. Additional personnel would be sourced through Woodside's arrangements to support an oiled wildlife response as required.

5.3.1 Response need based on predicted consequence parameters

The following statements identify the key parameters upon which a response need can be based:

- The modelling predicts that there would be no shoreline contact from floating oil above threshold for a marine diesel spill. The time to contact for floating oil at an offshore receptor is 5 hours at Montebello Marine Park. The time to contact for entrained hydrocarbons greater than 500 ppb is 5 hours at Montebello Marine Park (752 ppb) and 7.2 days at Gascoyne Marine Park (614 ppb). Operational monitoring would be deployed from the outset of a spill to track the spill location and fate in real-time and thus, in the event that wildlife are at risk of contamination, oiled wildlife response will be undertaken as and where required.
- The offshore location of the release site is expected to initially result in low numbers of at-risk or impacted wildlife.
- As the surface oil approaches shorelines, potential for oiled wildlife impacts are likely to increase.
- It is estimated that any oiled wildlife response would be between Level 1 and 2, as defined in the WA OWRP (Table 5-5).

Table 5-3: Key at-risk species in response protection areas and open ocean

Species	Open ocean	Ningaloo Coast	Montebello Marine Park	Montebello Islands and State Marine Park	Gascoyne Marine Park	Barrow Island	Lowendal Islands	Argo-Rowley Terrace CMR	Muiron Islands WHA & SMP	Rankin Bank	Glomar Shoals
Marine turtles	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Whale sharks	✓	✓			✓		✓		✓		
Seabirds and/or migratory shorebirds	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Cetaceans – migratory whales	✓	✓			✓		✓	✓	✓		
Cetaceans – dolphins and porpoises	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dugongs	✓	✓	✓	✓		✓	✓		✓		
Sharks and rays	✓	✓			✓		✓	✓	✓	✓	✓

The oiled wildlife response technique targets key wildlife populations at risk within Commonwealth open waters and the nearshore waters as described in Section 4 of the EP. Responding to oiled wildlife consists of eight key stages, as described in Table 5-4 below.

Table 5-4: Oiled wildlife response stages

Stage	Description
Stage 1: Wildlife first strike response	Gather situational awareness including potential wildlife assets at risk.
Stage 2: Mobilisation of wildlife resources	Resources include personnel, equipment and facilities.
Stage 3: Wildlife reconnaissance	Reconnaissance to identify potentially affected animals.
Stage 4: IAP wildlife sub-plan development	The IAP includes the appropriate response options for oiled wildlife, including wildlife priorities for protection from oiling; deterrence measures (see below); and recovery and treatment of oiled wildlife; resourcing of equipment and personnel. It includes consideration of deterrence practices such as ‘hazing’ to prevent wildlife from entering areas potentially contaminated by spilled hydrocarbons, as well as dispersing, displacing or relocating wildlife to minimise/prevent contact and provide time for clean-up.
Stage 5: Wildlife rescue and staging	This includes the different roles of finding oiled wildlife, capturing wildlife, and holding and/or transportation of wildlife to oiled wildlife facilities.
Stage 6: Establishment of an oiled wildlife facility	Treatment facilities would be required for the first-aid, cleaning and rehabilitation of affected animals. A vessel-based ‘on-water’ facility would likely need to be established to enable stabilisation of oiled wildlife before transport to a suitable treatment facility. Suitable staging sites in the Dampier and Exmouth have been identified in the draft Regional OWROP, should a land-based site be required.
Stage 7: Wildlife rehabilitation	Considerations include a suitable rehabilitation centre and personnel, wildlife housing, record keeping and success tracking.
Stage 8: Oiled wildlife response termination	Once a decision has been made to terminate operations, the Incident Controller will stand down individual participating and supporting agencies.

Reconnaissance and primary response would be done during operational monitoring and surveillance activities. Where marine wildlife are observed on water or transiting near or within the spill area, observations would be recorded through surveillance records. The shoreline assessments would be done in accordance with OM05, which would be used as a further tool to identify wildlife and habitats contacted by hydrocarbons.

Staging sites would be established as forward bases for shoreline- or vessel-based field teams. Once recovered to a staging site, wildlife would be transported to the designated oiled wildlife facility or a temporary holding centre (before being transported to the oiled wildlife facility). Temporary holding centres are required when there is significant distance between a staging site and the oiled wildlife facility, to enable stabilisation of oiled animals. The oiled wildlife facility is the primary location where animals would be housed and treated. Sites proposed for staging a regional oiled wildlife response in Dampier and Exmouth have been identified.

To deploy a response that is appropriate to the nature and scale of the event, as well as scalable over time, Woodside would implement an oiled wildlife response in consultation with DBAC and use the capability outlined in the WA OWRP, with additional capability if required (e.g. volunteers) accessible through Woodside's *People & Global Capability Surge Labour Requirement Plan*.

The WA OWRP provides indicative oiled wildlife response levels (Table 5-5) and the resources likely to be needed at each increasing level of response.

Table 5-5: Indicative oiled wildlife response level (adapted from the WA OWRP, 2014)

Oiled wildlife response Level	Indicative personnel numbers	Indicative duration	Indicative number of birds (non-threatened species)	Indicative number of birds (threatened species)	Turtles (hatchlings, juveniles, adults)	Cetaceans	Pinnipeds	Dugongs
Level 1	6	<3 days	1–2/day <5 total	No complex birds	None	None	None	None
Level 2	26	4–14 days	1–5/day <20 total	No complex birds	<20 hatchlings No juv/adults	None	None	None
Level 3	59	4–14 days	5–10/day <50 total	1–5/day <10 total	<5 juv/adults <50 hatchlings	None	<5	None
Level 4	77	>14 days	5–10/day <200 total	5–10/day	<20 juv/adults <500 hatchlings	<5, or known habitats affected	5–50	Habitat affected only
Level 5	116	>14 days	10–100/ day >200 total	10–50/day	>20 juv/adults >500 hatchlings	>5 dolphins	>50	Dugongs oiled
Level 6	122	>14 days	>100/day	10–50/day	>20 juv/adults >500 hatchlings	>5 dolphins	>50	Dugongs oiled

5.3.2 Environmental performance based on need

Table 5-6: Environmental Performance – Oiled Wildlife Response

Environmental Performance Outcome		Oiled Wildlife Response is conducted in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) to ensure it is conducted in accordance with legislative requirements to house, release or euthanise wildlilfe under the Animal Welfare Act 2002.		
Control measure		**Performance Standard**		**Measurement Criteria (Section 5.6)**
9	Wildlife response equipment	9.1	Contracted capability to treat 100 individual wildlife for immediate mobilisation to Response Protection Areas (RPAs).	1, 3A, 3B, 3C, 4
		9.2	Contracted capability to treat up to an additional 250 individual wildlife within a five-day period.	
		9.3	National plan access to additional resources under the guidance of the WA DoT (up to a Level 5 oiled wildlife response as specified in the OWRP), with the ability to treat about 600 individual wildlife by the time hydrocarbons contact the shoreline.	1, 3C, 4
		9.4	Vessels used in hazing/pre-emptive capture will approach wildlife at slow speeds to ensure animals are not directed towards the hydrocarbons.	1, 3A, 3B, 4
		9.5	Facilities for the rehabilitation of oiled wildlife are operational 24/7 as per WAOWRP.	1, 3A, 4
10	Wildlife responders	10.1	2 wildlife divisional commanders to lead the oiled wildlife operations who have completed an Oiled Wildlife Response Management course.	1, 2, 3B
		10.2	Wildlife responders to be accessed through resource pool and additional agreements with specialist providers.	1, 2, 3A, 3B, 3C, 4
		10.3	Oiled wildlife operations (including hazing) would be implemented with advice and assistance from the Oiled Wildlife Advisor from the DBCA, and in accordance with the processes and methodologies described in the WA OWRP and the relevant regional plan.	1
		10.4	Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s).	1, 3A, 3B
11	Management of environmental impact of the response risks	11.1	All oiled wildlife response sites zoned and marked before operations commence to prevent secondary contamination and minimise the mixing of clean and oiled waste.	1, 3A, 3B

The resulting wildlife response capability has been assessed against the WCCS. The range of techniques provide an ongoing approach to response at identified RPAs.

- Under optimal conditions the capability available meets the need identified for the duration of the spill.
- Woodside would establish a wildlife collection point at the RPA for identified oiled wildlife collection and sorting. From these locations, recovered wildlife would be transported to a central treatment location at Dampier or Exmouth.
- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures. Where control measures have been selected and implemented, they are included in Section 6.3.
- The health and safety, financial, capital and operations/maintenance costs of implementing the alternative, additional or improved control measures identified and not carried forward are considered clearly disproportionate to the environmental benefit gained and/or not reasonably practicable for this PAP.
- The Oiled Wildlife Response capability outlined in this section is part of the response developed to manage potential risks and impacts associated with the scenarios to ALARP, and there are no further additional, alternative and improved control measures other than those implemented that would provide further benefit.

5.4 Waste Management

Waste management is considered a support technique to offshore response operations, shoreline clean-up and wildlife response. Waste generated and collected during the response that will require handling, management and disposal may consist of:

- liquids (hydrocarbons and contaminated liquids) collected during offshore response, shoreline clean-up and wildlife response, and/or
- solids/semi-solids (oily solids, garbage, contaminated materials) and debris (e.g. seaweed, sand, woods, and plastics) collected during offshore response, shoreline clean-up and wildlife response.

Expected waste volumes during an event are likely to vary depending on oil type, volume released, response techniques employed and how weathering of hydrocarbons. Waste management, handling and capacity should be scalable to ensure continuous response operations can be maintained.

All waste management activities will follow the Environment Protection (Controlled Waste) Regulations 2004 and the waste will be managed to minimise final disposal volumes. Waste treatment techniques will consider contaminated solids treatment to allow disposal to landfill and solids with high concentrations of hydrocarbon will be treated and recycled where possible or used in clean fill if suitable.

The waste products would be transported from response locations to the nearest suitable staging area/waste transfer station for treatment, disposal or recycling. Waste will be transferred with appropriately licensed vehicles. Containers will be available for temporary waste storage and will be:

- labelled with the waste type
- provided with appropriate lids to prevent waste being blown overboard
- bunded if storing liquid wastes.
- processes will be in place for transfers of bulk liquid wastes and include:
  - inspection of transfer hose undertaken prior to transfer
  - watchman equipped with radio visually monitors loading hose during transfer
  - tank gauges monitored throughout operation to prevent overflow.

The *Oil Spill Preparedness Waste Management Support Plan* details the procedures, capability and capacity in place between Woodside and its primary waste services contractor to manage waste volumes generated from response activities.

5.4.1 Response need based on predicted consequence parameters

Modelling predicts that there will be no floating oil at recoverable threshold concentrations and no shoreline contact at feasible clean-up threshold concentrations, thus the only waste management consideration will be for oiled wildlife response.

Table 5-7: Response Planning Assumptions – Waste Management

	Response planning assumptions: Waste management
Waste loading per m^3 oil recovered (multiplier)	Oiled wildlife response – approximately 1 m^3 of oily liquid waste generated for each wildlife unit cleaned.

5.4.2 Environmental performance based on need

Table 5-8: Environmental Performance – Waste Management

Environmental Performance Outcome		To minimise further impacts, waste will be managed, tracked and disposed of in accordance with laws and regulations.		
Control measure		**Performance Standard**		**Measurement Criteria (Section 5.7)**
12	Waste Management	12.1	Contract with waste management services for transport, removal, treatment and disposal of waste.	1, 3A, 3B, 3C, 4
		12.2	Recovered hydrocarbons and wastes will be transferred to licensed treatment facility for reprocessing or disposal.	
		12.3	Teams will segregate liquid and solid wastes at the earliest opportunity.	
		12.4	Waste management provider support staff available year-round to assist in the event of an incident with waste management as detailed in contract.	
		12.5	Open communication line to be maintained between IMT and waste management services to ensure the reliable flow of accurate information between parties.	1, 3A, 3B
		12.6	Waste management to be conducted in accordance with Australian laws and regulations.	1, 3A, 3B, 3C, 4
		12.7	Waste management services available and employed during response.	

The resulting waste management capability has been assessed against the WCCS. The range of techniques provide an ongoing approach to waste management at identified RPAs.

Given that modelling predicts that there will be no floating oil at recoverable threshold concentrations and no shoreline contact at feasible clean-up threshold concentrations, the only waste management requirements will be for oiled wildlife response and the capability available therefore exceeds the need identified.

- Woodside's waste service provider has the capacity to treat up to 120,000 m^3 overall waste volumes. The waste management requirements are within Woodside's and its service providers' existing capacity.
- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures. Where control measures have been selected and implemented, they are included in Section 6.4.
- The health and safety, financial, capital and operations/maintenance costs of implementing the alternative, additional or improved control measures identified and not carried forward are considered clearly disproportionate to the environmental benefit gained and/or not reasonably practicable for this PAP.
- The waste management capability outlined in this section is part of the response developed to manage potential risks and impacts associated with the scenarios to ALARP, and there are no further additional, alternative and improved control measures other than those implemented that would provide further benefit.

5.5 Scientific monitoring

A scientific monitoring program (SMP) would be activated following a Level two or three unplanned hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors. This would consider receptors at risk (ecological and socio-economic) for the entire predicted Environment that Maybe Affected (EMBA) and in particular, any identified Pre-emptive Baseline Areas (PBAs) for the credible spill scenario(s) or other identified unplanned hydrocarbon releases associated with the operational activities (refer to Table 2-1: PAP credible spill scenarios).

The outputs of the stochastic hydrocarbon spill modelling were used to assess the environmental risk of the hydrocarbon affected area as delineated by the ecological impact EMBA and social-cultural EMBA based on exceedance of environmental and social-cultural hydrocarbon threshold concentrations (refer to Table 2-2, Section 2.3.1.1 and see Section 4 and 6 of the EP for further information on applicable thresholds and the EMBAs). The Petroleum Activities Program worst-case credible spill MEE-01 define the EMBAs and are the basis of the SMP approach presented in this section

It should be noted that the resulting SMP receptor locations differ from the Response Protection Areas (RPAs) presented and discussed in Section 3 of this document due to the applicability of different hydrocarbon threshold levels. The SMP would be informed by the data collected via the operational monitoring program (OMP) studies, however, it differs from the OMP in being a long-term program independent of, and not directing, the operational oil spill response or monitoring of impacts from response activities (refer to Section 5.1) for operational monitoring overview).

Key objectives of the Woodside oil spill SMP are:

- Assess the extent, severity and persistence of the environmental impacts from the spill event; and
- Monitor subsequent recovery of impacted key species, habitats and ecosystems.

The SMP comprises ten targeted environmental monitoring programs to assess the condition of a range of physico-chemical (water and sediment) and biological (species and habitats) receptors including EPBC Act listed species, environmental values associated with protected areas and socio-economic values, such as fisheries. The ten SMPs are as follows:

- SM01 - Assessment of the presence, quantity and character of hydrocarbons in marine waters (linked to OM01 to OM03)
- SM02 - Assessment of the presence, quantity and character of hydrocarbons in marine sediments (linked to OM01 and OM05)
- SM03 – Assessment of impacts and recovery of subtidal and intertidal benthos
- SM04 - Assessment of impacts and recovery of mangroves/saltmarsh habitat
- SM05 - Assessment of impacts and recovery of seabird and shorebird populations
- SM06 - Assessment of impacts and recovery of nesting marine turtle populations
- SM07 - Assessment of impacts to pinniped colonies including haul-out site populations
- SM08 - Desktop assessment of impacts to other non-avian marine megafauna
- SM09 - Assessment of impacts and recovery of marine fish (linked to SM03)
- SM10 - Assessment of physiological impacts to important fish and shellfish species (fish health and seafood quality/safety) and recovery.

These SMPs have been designed to cover all key tropical and temperate habitats and species within Australian waters and broader, if required. A planning area for scientific monitoring is also identified to acknowledge potential hydrocarbon contact below the environmental threshold concentrations and beyond the EMBA. This planning area has been set with reference to the entrained low exposure value of 10 ppb detailed in NOPSEMA Bulletin #1 Oil Spill Modelling (2019), as shown in Figure 5-1.

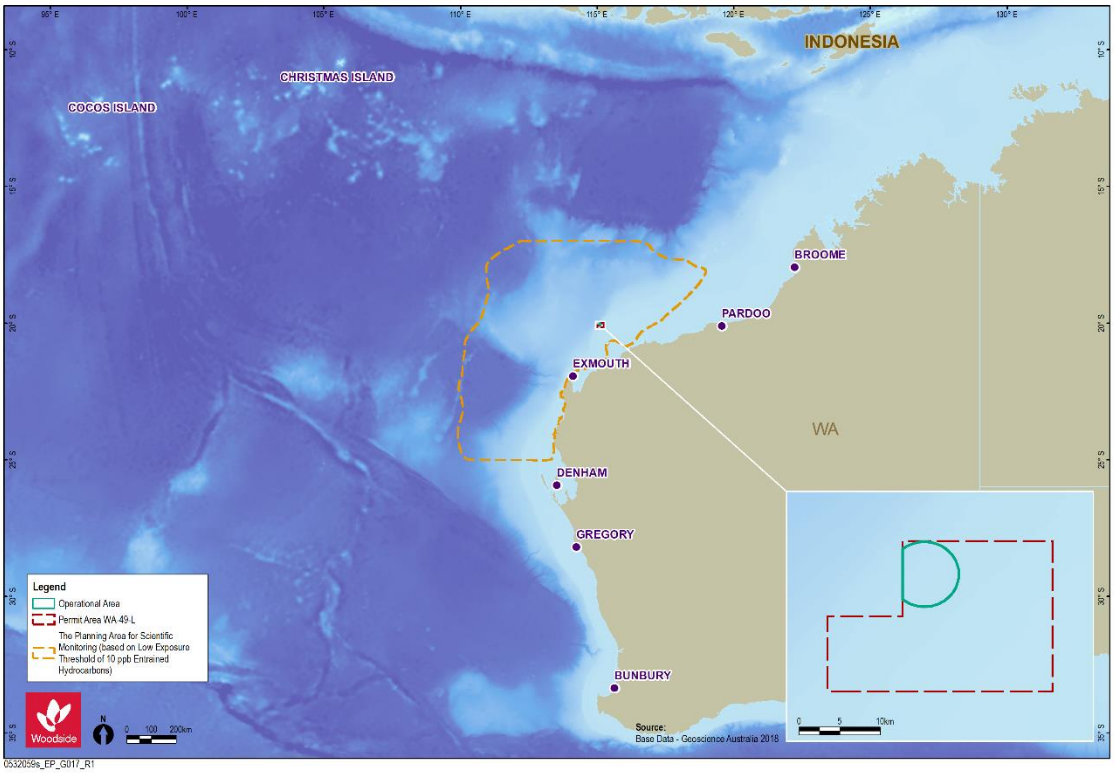

Figure 5-1: The planning area for scientific monitoring based on the area potentially contacted by the low (below ecological impact) entrained hydrocarbon threshold of 10 ppb in the event of the worst-case credible spill scenario (MEE-01).

Please note that Figure 5-1 represents the overall combined extent of the oil spill model outputs based on a total of 100 replicate simulations over an annual period for MEE-01 and therefore represents the largest spatial boundaries of 100 MEE-01 oil spill combinations, not the spatial extent of a single MEE-01 spill.

5.5.1 Scientific Monitoring Deployment Considerations

Table 5-9: Scientific monitoring deployment considerations

Scientific Monitoring Deployment Considerations	
Existing baseline studies for sensitive receptor locations predicted to be affected by a spill	PBAs of the following two categories: • PBAs within the predicted <10-day hydrocarbon contact time prediction: The approach is to conduct a desktop review of available and appropriate baseline data for key receptors for locations (if any) that are potentially impacted within 10 days of a spill and look to conduct baseline data collection to address data gaps and demonstrate spill response preparedness. Planning for baseline data acquisition is typically commenced pre-PAP and execution of studies undertaken with consideration of weather, receptor type, seasonality and temporal assessment requirements. • PBAs >10 days' time to predicted hydrocarbon contact in the event of an unplanned hydrocarbon release (from the facility operational activities). SMP activation (as per the WA-49-L Gemtree Anchor Hold Testing FSP) directs the SMP team to follow the steps outlined in the SMP Operational Plan. The steps include: checking the availability and type of existing baseline data, with particular reference to any PBAs identified as >10 days to hydrocarbon contact. Such information is used to identify response phase PBAs and plan for the activation of SMPs for pre-emptive (i.e. pre-hydrocarbon contact) baseline assessment.
Pre-emptive Baseline in the event of a spill	Activation of SMPs in order to collect baseline data at sensitive receptor locations with predicted hydrocarbon contact time >10 days (as documented in ANNEX C).
Survey platform suitability and availability	In the event of the SMP activation, suitable survey platforms are available and can support the range of equipment and data collection methodologies to be implemented in nearshore and offshore marine environments.
Trained personnel to implement SMPs suitable and available.	Access to trained personnel and the sampling equipment contracted for scientific monitoring via a dedicated scientific monitoring program standby contract.
Met-ocean conditions	The following met-ocean conditions have been identified to implement SMPs: • Waves <one m for nearshore systems • Waves <1.5 m for offshore systems • Winds <20 knots • Daylight operations only SMP implementation will be planned and managed according to HSE risk reviews and the met-ocean conditions on a day to day basis by SMP operations.

5.5.2 Response planning assumptions

Table 5-10: Scientific monitoring response planning assumptions

Response Planning Assumptions	
PBAs	PBAs identified through the application of defined hydrocarbon impact thresholds during the Quantitative Spill Risk Assessment process and a consideration of the minimum time to contact at receptor locations fall into two categories: • PBAs for which baseline data are planned for and data collection may commence pre-PAP (≤ 10 days minimum time to contact), where identified as a gap. • PBAs (> 10 days minimum time to contact) for which baseline data may be collected in the event of an unplanned hydrocarbon release. Response phase PBAs are prioritised for SMP activities due to vulnerability (i.e. time to contact and environmental sensitivity) to potential impacts from hydrocarbon contact and an identified need to acquire baseline data.

Response Planning Assumptions	
	Time to hydrocarbon contact of >10 days has been identified as a minimum timeframe within which it is feasible to plan and mobilise applicable SMPs and commence collection of baseline (pre-hydrocarbon contact) data, in the event of an unplanned hydrocarbon release from WA-49-L Gemtree Anchor Hold Testing. PBAs for WA-49-L Gemtree Anchor Hold Testing are identified and listed in ANNEX D, Table D-1. The PBAs together with the situational awareness (from the operational monitoring) are the basis for the response phase SMP planning and implementation.
Pre-Spill	A review of existing baseline data for receptor locations with potential to be contacted by floating or entrained hydrocarbons at environmental thresholds within ≤10 days has identified the following: • Rankin Bank[6] For example, adequate baseline data are available for Rankin Bank as last surveyed (benthic communities and fish assemblages) in November 2018 (Currey-Randall et al., 2019). Australian Marine Parks (AMPs) potentially affected includes: • Montebello AMP • Gascoyne AMP All the Australian Marine Parks (AMPs) are located in offshore waters where hydrocarbon contact is possible on surface waters (floating hydrocarbons) and in the water column (entrained hydrocarbons).
In the Event of a Spill	Locations with >10 days to hydrocarbon contact, as well as the wider area, will be investigated and identified by the SMP team (in the Planning Environment Unit of the Incident Control Centre (ICC)) as the spill event unfolds and as the situational awareness provided by the OMPs permits delineation of the spill affected area (for example, updates to the spill trajectory tracking). To address the initial focus in a response phase SMP planning situation, Rankin Bank, Montebello AMP, Gascoyne AMP and the Commonwealth marine environment are the key receptor locations predicted to be contacted in less than 20 days. The nature and scale of the spill indicates that there are no key receptors within geographic locations that are potentially impacted after 10 days. Following a spill event or commencement of the spill and where adequate and appropriate baseline data are not available, there will be a response phase effort to collect baseline data.
Baseline Data	Not applicable, however, a SMP activation process will be stood up and can assess the spill event as it unfolds to ensure baseline data collection is possible, if required.

5.5.3 Summary – scientific monitoring

The resulting scientific monitoring capability has been assessed against the PAP worst case credible spill scenarios. The range of strategies provide an ongoing approach to monitoring operations to assess and evaluate the scale and extent of impacts. All known reasonably practicable control measures have been adopted with the cost and organisational complexity of these options determined to be moderate and the overall delivery effectiveness determined to be medium. The SMP's main objectives can be met, with no additional, alternative or improved control measures providing further benefit.

[6] Only entrained hydrocarbon contact is predicted at Rankin Bank ≤10 days. A precautionary approach for this SMP has been adopted by including Rankin Bank.

5.5.4 Response planning: need, capability and gap – scientific monitoring

As the exact locations where hydrocarbon contact occurs may be unpredictable, SM01 would be mobilised as a priority to be able to detect hydrocarbons and track the leading edge of the spill to verify where hydrocarbon contact occurs which will assist with where SMP resources are a priority need to obtain pre-emptive baseline data.

The option analysis in Section 6.5 considers ways to reduce the gap by considering alternate, additional, and/or improved control measures on each selected response strategy.

5.5.5 Environmental performance based on need

Table 5-11: Environmental Performance – Scientific Monitoring

Environmental Performance Outcome		Woodside can demonstrate preparedness to stand up the SMP to quantitatively assess and report on the extent, severity, persistence and recovery of sensitive receptors impacted from the spill event.		
Control measure		**Performance Standard**		**Measurement Criteria**
13	• Woodside has an established and dedicated SMP team comprising the Environmental Science Team and additional Environment Advisers within the Health Safety Environment and Quality (HSEQ) Function.	13.1	SMP team comprises a pool of competent Environment Advisers (stand up personnel) who receive training regarding the SMP, SMP activation and implementation of the SMP on an annual basis.	• Training materials. • Training attendance registers. Process that maps minimum qualification and experience with key SMP role competency and a tracker to manage availability of competent people for the SMP team including redundancy and rostering.
14	• Woodside have contracted SMP service provider to provide scientific personnel to resource a base capability of one team per SMP (SM01-SM10, see ANNEX C Table C-2) as detailed in Woodside's SMP standby contractor Implementation Plan, to implement the oil spill scientific monitoring programs. The availability of relevant personnel is reported to Woodside on a monthly basis via a simple report on the base-loading availability of people for each of the SMPs comprising field work for data collection (SMP resourcing report register). • In the event of a spill and the SMP is activated, the base-loading availability of scientific personnel will be provided by SMP standby contractor for the individual SMPs and where gaps in resources are identified, SMP standby contractor/Woodside will seek additional personnel (if needed) from	14.1	Woodside maintains the capability to mobilise personnel required to conduct scientific monitoring programs SM01 – SM10 (except desktop based SM08): • Personnel are sourced through the existing standby contract with SMP standby contractor, as detailed within the SMP Implementation Plan. • Scientific Monitoring Program Implementation Plan describes the process for	• OSPU Internal Control Environment tracks the quarterly review of the Oil Spill Contracts Master. • SMP resource report of personnel availability provided by SMP contractor on monthly basis (SMP resourcing report register. • Training materials. • Training attendance registers.

Environmental Performance Outcome		Woodside can demonstrate preparedness to stand up the SMP to quantitatively assess and report on the extent, severity, persistence and recovery of sensitive receptors impacted from the spill event.		
Control measure		**Performance Standard**		**Measurement Criteria**
	other sources including Woodside's Environmental Services Panel.		standing up and implementing the scientific monitoring programs. SMP team stand up personnel receive training regarding the stand up, activation and implementation of the SMP on an annual basis.	• Competency criteria for SMP roles. SMP annual arrangement testing and reporting.
15	• Roles and responsibilities for SMP implementation are captured in Table C-1 (ANNEX C) and the SMP team (as per the organisational structure of the ICC) is outlined in SMP Operational Plan. Woodside has a defined Crisis and Incident Management structure including Source Control, Operations, Planning and Logistics functions to manage a loss of marine diesel response. • SMP Team structure, interface with SMP standby contractor and linkage to the ICC is presented in Figure C-1, ANNEX C. • Woodside has a defined Command, Control and Coordination structure for Incident and Emergency Management that is based on the AIIMS framework utilised in Australia. • Woodside utilises an online Incident Management Information System (IMIS) to coordinate and track key incident management functions. This includes specialist modelling programs, geographic information systems (GIS), as well as communication flows within the Command, Control and Coordination structure. • SMP activated via the FSRP. • Step by step process to activation of individual SMPs provided in the SMP Operational Plan. • All decisions made regarding SMP logged in the online IMIS (SMP team members trained in using Woodside's online Incident Management System). • SMP component input to the ICC IAP as per the identified ICC timed sessions and the SMP IAP logged on the online IMIS.	15.1	• Woodside have established an SMP organisational structure and processes to stand up and deliver the SMP.	• SMP Oil Spill Scientific Monitoring Operational Plan. • SMP Implementation Plan. • SMP annual arrangement testing and reporting.

Environmental Performance Outcome		Woodside can demonstrate preparedness to stand up the SMP to quantitatively assess and report on the extent, severity, persistence and recovery of sensitive receptors impacted from the spill event.		
Control measure		**Performance Standard**		**Measurement Criteria**
	• Woodside Environmental Science Team provide awareness training on the activation and stand-up of the Scientific Monitoring Programme (SMP) for the Environment Advisers in Woodside who are listed on the SMP team on an annual basis. • Woodside Environmental Science Team provide awareness training on the activation and stand-up of the Scientific Monitoring Programme (SMP) for the SMP Standby provider. • Woodside Environmental Science Team co-ordinates an annual SMP arrangement testing exercise which the Standby SMP contractor SMP team participates in since 2016 (report on 2016 SMP simulation: and Standby SMP contractor SMP arrangements (people and equipment availability) tested annually since 2016.			
16	• Chartered and mutual aid vessels. • Suitable vessels would be secured from the Woodside support vessels, regional fleet of vessels operated by Woodside and other operators and the regional charter market. • Vessel suitability will be guided by the need to be equipped to operate grab samplers, drop camera systems and water sampling equipment (the individual vessel requirements are outlined in the relevant SMP methodologies (refer to Table C-2, ANNEX C). • Nearshore mainland waters could use the same approach as for open water. Smaller vessels may be used where available and appropriate. Suitable vehicles and machinery for onshore access to nearshore SMP locations would be provided by Woodside's transport services contract and sourced from the wider market. • Dedicated survey equipment requirements for scientific monitoring range from remote towed video and drop camera systems to capture seabed images of benthic communities to intertidal/onshore surveying tools such as quadrats, theodolites and spades/trowels, cameras and binoculars (specific survey equipment	16.1	Woodside maintains standby SMP capability to mobilise equipment required to conduct scientific monitoring programs SM01 – SM10 (except desktop based SM08): • Equipment are sourced through the existing standby contract with Standby SMP standby contractor, as detailed within the SMP Implementation Plan.	• OSPU Internal Control Environment tracks the quarterly review of the Oil Spill Contracts Master. • SMP standby monthly resource reports of equipment availability provided by SMP contractor (SMP resourcing report register). • SMP annual arrangement testing and reporting.

Environmental Performance Outcome		Woodside can demonstrate preparedness to stand up the SMP to quantitatively assess and report on the extent, severity, persistence and recovery of sensitive receptors impacted from the spill event.		
Control measure		**Performance Standard**		**Measurement Criteria**
	requirements are outlined in the relevant SMP methodologies (refer to Table C-2, ANNEX C)). Equipment would be sourced through the existing SMP standby contract with Standby SMP contractor for SMP resources and if additional surge capacity is required this would be available through the other Woodside Environmental Services Panel Contractors and specialist contractors. Standby SMP contractor can also address equipment redundancy through either individual or multiple suppliers. MoUs are in place with marine sampling equipment suppliers and analytical laboratories (SMP resourcing report register). • Availability of SMP equipment for offshore/onshore scientific monitoring team mobilisation is within one week to ten days of the commencement of a hydrocarbon release. This meets the SMP mobilisation lead time that will support meeting the response objective of 'acquire, where practicable, the environmental baseline data prior to hydrocarbon contact required to support the post-response SMP.			
17	Woodside's SMP approach addresses the pre-PAP acquisition of baseline data for PBAs with ≤10 days if required following a baseline gap analysis process. Woodside maintains knowledge of Environmental Baseline data through: • Documentation annual reviews of the Woodside Baseline Environmental Studies Database, and specific activity baseline gap analyses. • Industry-Government Environmental Meta-database (IGEM) Baseline Studies Database: http://www.igem.com.au/landing/ (Note – the IGEM password is documented in the SMP Operational Plan).	17.1	• Annual reviews of environmental baseline data. • PAP specific Pre-emptive Baseline Area baseline gap analysis.	• Annual review/update of Woodside Baseline Environmental Studies Database. • Desktop review to assess the environmental baseline study gaps completed prior to EP submission. • Accessing baseline knowledge via the SMP annual arrangement testing.

<table>
<tr><th colspan="2">Environmental Performance Outcome</th><th colspan="3">SMP plan to acquire response phase monitoring targeting pre-emptive data achieved.</th></tr>
<tr><th colspan="2">Control measure</th><th colspan="2">Performance Standard</th><th>Measurement Criteria</th></tr>
<tr><td rowspan="2">18</td><td rowspan="2">Woodside's SMP approach addresses:
• Scientific data acquisition for PBAs >10 days to hydrocarbon contact and activated in the response phase and
• Transition into post-response SMP monitoring.</td><td>18.1</td><td><u>PBA baseline data acquisition in the response phase</u>

If baseline data gaps are identified for PBAs that has predicted hydrocarbon contact (contact time >10 days), there will be a response phase effort to collect baseline data with priority in implementing SMPs given to receptors where pre-emptive baseline data can be acquired or improved.

SMP team (within the Environment Unit of the ICC) contribute SMP component of the ICC Planning Function in development of the IAP.</td><td>• Response SMP plan.
• Woodside's online Incident Management System Records.
• SMP component of the Incident Action Plan.</td></tr>
<tr><td>18.2</td><td><u>Post Spill contact</u>
For the receptors contacted by the spill in where baseline data are available, SMPs programs to assess and monitor receptor condition will be implemented post spill (i.e. after the response phase):</td><td>• SMP planning document.
• SMP Decision Log.
• IAPs.</td></tr>
</table>

<table>
<tr><th colspan="2">Environmental Performance Outcome</th><th colspan="3">Implementation of the SMP (response and post-response phases).</th></tr>
<tr><th colspan="2">Control measure</th><th colspan="2">Performance Standard</th><th>Measurement Criteria</th></tr>
<tr><td rowspan="3">19</td><td rowspan="3">Scientific monitoring will address quantitative assessment of environmental impacts of a level two or three spill or any release event with the potential to contact sensitive environmental receptors. The SMP comprises ten targeted environmental monitoring programs.
SMP supporting documentation: (1) Oil Spill Scientific Monitoring Operational Plan; (2) SMP Implementation Plan and (3) SMP Process and Methodologies Guideline.
The Oil Spill Scientific Monitoring Operational Plan details the process of SMP selection, input to the IAP to trigger operational logistic support services. Methodology documents for each of the ten SMPs are accessible detailing equipment, data collection techniques and the specifications required for the survey platform support.
The SMP standby contractor holds a Woodside SMP implementation plan detailing activation processes, linkage with the Woodside SMP team and the general principles for the planning and mobilisation of SMPs to deliver the individual SMPs activated. Monthly resourcing report are issued by the SMP standby contractor (SMP resourcing report register). All SMP documents and their status are tracked via SMP document register.</td><td>19.1</td><td>Implementation of SM01
SM01 will be implemented to assess the presence, quantity and character of hydrocarbons in marine waters during the spill event in nearshore areas.</td><td>Evidence SM01 has been triggered:
Documentation as per requirements of the SMP Operational Plan.
Woodside's online Incident Management System Records.
SMP component of the IAP.
SMP data records from field.</td></tr>
<tr><td>19.2</td><td>Implementation of SM02-SM10
SM02-SM10 will be implemented in accordance with the objectives and activation triggers as per Table C-2 of ANNEX C.</td><td>Evidence SMPs have been triggered:
Documentation as per requirements of the SMP Operational Plan.
Woodside's online Incident Management System Records.
SMP component of the IAP.
SMP Data records from field.</td></tr>
<tr><td>19.3</td><td>Termination of SMP plans
The Scientific Monitoring Program will be terminated in accordance with termination triggers for the SMP's detailed in Table C-2 of ANNEX C, and the Termination Criteria Decision-tree for Oil Spill Environmental Monitoring (Figure C-3 of ANNEX C):</td><td>Evidence of Termination Criteria triggered:
Documentation and approval by relevant stakeholders to end SMPs for specific receptor types.</td></tr>
</table>

5.6 Incident Management System

The Incident Management System is both a control measure and a measurement criteria. As a control measure the IMS function is to prompt, facilitate and record the completion of three key response planning processes detailed below. As a measurement criteria, the IMS records the evidence of the timeliness of all response actions included in the environmental performance standards and the plans used of the PAP.

As the IMS does not directly remove hydrocarbons spilt into the marine environment there is no direct relationship to the response planning need.

5.6.1 Incident action planning

The ICC will be required to collect and interpret information from the scene of the incident to determine support requirements to the site-based IMT, develop an IAP and assist the IMT with the execution of that plan. The site-based IC may request the ICC to complete notifications internally within Woodside, to stakeholders and government agencies as required. Depending on the type and scale of the incident either the ICC Duty Manager (DM) or IC will be responsible for ensuring the development of the IAP. Incident Action Planning is an ongoing process that involves continual review to ensure techniques to control the incident are appropriate to the situation at the time.

5.6.2 Operational NEBA process

In the event of a response Woodside will confirm that the response techniques adopted at the time of EP/OPEP acceptance remain appropriate to reduce the consequences of the spill. This process verifies that there is a continuing net environmental benefit associated with continuing the response technique through the operational NEBA process. This process manages the environmental risks and impacts of response techniques during the spill response, an operational NEBA will be undertaken throughout the response, for each operational period.

The operational NEBA will consider the risks and benefits of conducting and response activity. For example, if vessels are required for access to nearshore or onshore areas, anchoring locations will be selected to minimise disturbance to benthic habitats. Vessel cleanliness would be commensurate with the receiving environment. The operational NEBA will consider the risks and benefits of conducting other response techniques.

The operational NEBA process is also used to terminate a response. Using data from operational and scientific monitoring activities the response to a hydrocarbon spill will be terminated in accordance with the termination process outlined in the OPEA. In effect the operational NEBA will determine whether there is net environmental benefit to continue response operations.

5.6.3 Stakeholder engagement process

Woodside will ensure stakeholders are engaged during the spill response in accordance with internal standards. This process requires that Woodside will:

- Undertake all required notifications (including government notifications) for stakeholders in the region (identified in the FSP). This includes notification to mariners to communicate navigational hazards introduced through response equipment and personnel.
- In the event of a response, identify and engage with relevant stakeholders and continually assess and review.

5.6.4 Environmental performance based on need

Table 5-12: Environmental Performance – Incident Management System

Environmental Performance Outcome		To support the effectiveness of all other control measures and monitor/record the performance levels achieved.		
Control measure		**Performance Standard**		**Measurement Criteria (Section 5.7)**
20	Operational SIMA	20.1	Confirm that the response strategies adopted at the time of acceptance remain appropriate to reduce the consequences of the spill within 24 hours.	1, 3A
		20.2	Record the evidence and justification for any deviation from the planned response activities.	
		20.3	Record the information and data from operational and scientific monitoring activities used to inform the SIMA.	
21	Stakeholder engagement	21.1	Prompt and record all notifications (including government notifications) for stakeholders in the region are made.	
		21.2	In the event of a response, identification of relevant stakeholders will be re-assessed throughout the response period.	
		21.3	Undertake communications in accordance with: 1) Woodside Crisis Management Functional Support Team Guideline – Reputation 2) External Communication Operating Standard External Stakeholder Engagement Operating Standard	
22	Personnel required to support any response	22.1	Action planning is an ongoing process that involves continual review to ensure strategies to control the incident are appropriate to the situation at the time.	1, 3B
		22.2	A duty roster of trained and competent people will be maintained to ensure that minimum manning requirements are met all year round.	3C
		22.3	Immediately activate the IMT with personnel filling one or more of the following roles: • Operations Duty Manager; • D&C Duty Manager; • Operations Coordinator; • Deputy Operations Coordinator; • Planning Coordinator; • Logistics (materials, aviation, marine and support positions); • Management Support; • Health and Safety Advisor; • Environment Duty Manager; • People Coordinator; • Public Information Coordinator; • Intelligence Coordinator; and • Finance Coordinator.	1, 2, 3B, 3C, 4
		22.4	Collect and interpret information from the scene of the incident to determine support requirements to the site-based IMT, develop an IAP and assist with the execution of that plan.	
		22.5	S&EM advisors will be integrated into ICC to monitor performance of all functional roles.	
		22.6	Continually communicate the status of the spill and support Woodside to determine the most appropriate response by delivering on the responsibilities of their role.	
		22.7	Follow the OPEA, Operational Plans, FSPs, support plans and the IAPs developed.	1, 2, 3A, 4
		22.8	Contribute to Woodside's response in accordance with the aims and objectives set by the Duty Manager.	1, 2, 3B, 3C, 4

5.7 Measurement criteria for all response techniques

Woodside ensures compliance with environmental performance outcomes and standards through four primary mechanisms. The performance tables aforementioned identify which of these four mechanisms monitors the readiness, and records the effectiveness and performance of the control measures adopted.

1. The Incident Management System

The Incident Management System (IMS) supports the implementation of the Emergency & Crisis Management Procedure. The IMS provides a near real-time, single source of information for monitoring and recording an incident and measuring the performance of those control measures.

The Emergency & Crisis Management Procedure defines the management framework, including roles and responsibilities, to be applied to any size incident (including hydrocarbon spills). The organisational structure required to manage an incident is developed in a modular fashion and is based on the specific requirements of each incident. The structure can be scaled up or down.

The IAP process formally documents and communicated the:

- incident objectives;
- status of assets;
- operational period objectives;
- response techniques (defined during response planning);
- the effectiveness of response techniques.

The information captured in the IMS (including information from personal logs and assigned tasks/close outs) confirms the response techniques implemented remain appropriate to reduce the consequences of the spill. The system also records all information and data that can be used to support the site-based IMT, development and the execution of the IAP.

2. The Security & Emergency Management Competency Dashboard

The Security & Emergency Management (S&EM) competency dashboard records the number of trained and competent responders that are available across Woodside, and some external providers, to participate in a response.

This number varies dependent on expiry of competency certificates, staff attrition, internal rotations, leave and other absences. As such the Dashboard is designed to identify the minimum manning requirements and to identify sufficient redundancy to cater for the variances listed above.

Figure 5-2 shows the minimum manning numbers for the different hydrocarbon spill response roles and the number of qualified persons against those roles.

Woodside's pool of trained responders is composed of but not limited to personnel from the following organisations:

- Woodside internal
- AMOSC core group
- AMOSC
- OSRL
- Marine Spill Response Corporation (MSRC)
- AMSA
- Woodside contracted workforce

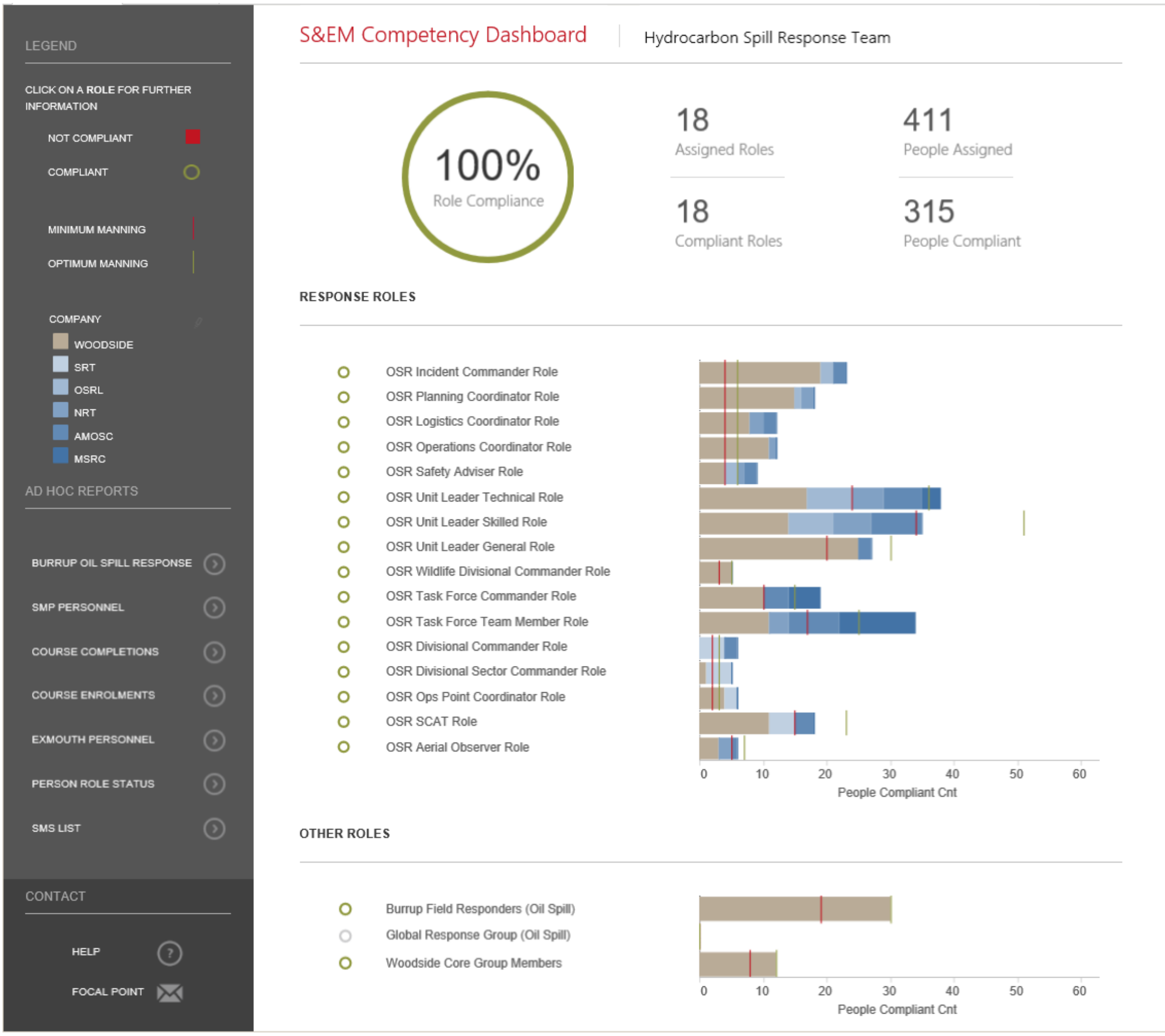

Figure 5-2: Example screenshot of the Hydrocarbon Spill Preparedness competency dashboard

The Dashboard is one of Woodside's key means of monitoring its readiness to respond. It also shows that Woodside can meet the requirements of the environmental performance standard that relate to filling certain response roles.

Figure 5-3 shows deeper dive into the Operations Point Coordinator role and the training modules required to show competence.

Employee Name	Location	WOP ID	OSR Coordinate Incident Response	OSR Exercise Participation 3 Yearly Initial	OSR Exercise Participation 3 Yearly - Refresher	OSR Oil Spill Response Theory
4 XXXX	Perth	XXXX	Completed:12/09/2014 No Expiry	Completed:24/07/2018 No Expiry	Completed:24/07/2018 Expires On:23/07/2021	Completed:25/05/2016 No Expiry
4 XXXX	Karratha KGP	XXXX	Completed:18/12/2014 No Expiry	Completed:27/06/2018 No Expiry	Completed:27/06/2018 Expires On:26/06/2021	Completed:09/09/2016 No Expiry
4 XXXX	Perth	XXXX	Completed:10/06/2014 No Expiry	Completed:06/06/2018 No Expiry	Completed:06/06/2018 Expires On:05/06/2021	Completed:09/12/2014 No Expiry
2 XXXX	Perth	XXXX	Assigned: 25/08/2017	Completed:06/06/2018 No Expiry	Completed:06/06/2018 Expires On:05/06/2021	Completed:07/07/2016 No Expiry

Figure 5-3: Example screenshot for the Operations Point Coordinator role

3. The Hydrocarbon Spill Preparedness ICE Assurance Process

The Hydrocarbon Spill Response Team has developed a Hydrocarbon Spill Preparedness and Response Internal Control Environment (ICE) process to align and feed into the Woodside Management System Assurance process for hydrocarbon spill. The process tracks compliance over four key control areas:

a) **Plans** – Ensures all plans (including: OPEA, FSPs, operational plans, support plans and TRPs) are current and in line with regulatory and internal requirements.
b) **Competency** – Ensures the competency dashboard is up to date and there are the minimum competency numbers across ICC, CMT and hydrocarbon spill response roles. The hydrocarbon spill training plan and exercise schedule, including testing of arrangements is also tracked. The Testing of Arrangements (TOA) register tracks the testing of all hydrocarbon spill response arrangements, key contracts and agreements in place with internal and external parties to ensure compliance.
c) **Capability** – Tracks and monitors capability that could be required in a hydrocarbon incident, including but not limited to: integrated fleet vessel schedule, dispersant availability, rig/vessels monitoring, equipment stockpiles, tracking buoy locations and the CICC duty roster.
d) **Compliance & Assurance** – Ensures all regulator inspection outcomes are actioned and closed out, the global legislation register is up to date and that the key assurance components are tracked and managed. Assurance activities (including Audits) conducted on memberships with key Oil Spill Response Organisations (OSROs) including AMOSC and OSRL are also tracked and recorded in the ICE.

The ICE assurance process records how each commitment listed in the performance tables above is managed to ensure ongoing compliance monitoring. The level of compliance can be reviewed in real time and is reported on a monthly basis through the S&EM Function.

The completion of the assurance checks (over and above the ICE process) is also applied via the Woodside Integrated Risk & Compliance System (WiRCs) and subject to the requirements of Woodside's Provide Assurance Procedure

4. The Hydrocarbon Spill Preparedness and Response Procedure

This procedure sets out how to plan and prepare for a liquid hydrocarbon spill to the marine environment (Note, this procedure does not apply to scenarios relating to gas releases in the marine environment).

This procedure details the:

- Requirement for an OPEP to be developed, maintained, reviewed, and approved by appropriate regulators (where applicable) including:
  - Defining how spill scenarios are developed on an activity specific basis;
  - Developing and maintaining all hydrocarbon spill related plans;
  - Ensuring the ongoing maintenance of training and competency for personnel;
  - Developing the testing of spill response arrangements; and
  - Maintaining access to identified equipment and personnel.
- Planning for hydrocarbon spill response preparedness
- Accountabilities for hydrocarbon spill response preparedness
- Spill training requirements
- Requirements for spill exercising / testing of spill response arrangements
- Spill equipment and services requirements.

The procedure also details the roles and responsibilities of the dedicated Woodside Hydrocarbon Spill Preparedness team. This team is responsible for:

- Assuring that Woodside hydrocarbon spill responders meet competency requirements
- Establishing the competency requirements, annual training schedule and a training register of trained personnel

- Establishing and maintaining the total numbers of trained personnel required to provide an effective response to any hydrocarbon spill incident
- Ensuring equipment and services contracts are maintained
- Establishing OPEPs
- Establishing OPEAs
- Priority response receptor determination
- ALARP determination
- Ensuring compliance and assurance is undertaken in accordance with external and internal requirements

6 ALARP EVALUATION

This Section should be read in conjunction with Section 5 which is the capability planned for this activity.

6.1 Monitor and Evaluate – ALARP Assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.1.1 Monitor and Evaluate – Control Measure Options Analysis

6.1.1.1 Alternative Control Measures

Alternative Control Measures considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Aerostat (or similar inflatable observation platform) for localised aerial surveillance.	Lead time to Aerostat surveillance is disproportionate to the environmental benefit. The system also provides a very limited field of visibility around the vessel it is deployed from.	Long lead time to access (>10 days). Each system would require an operator to interpret data and direct vessels accordingly. Requires multiple systems for shoreline use.	Purchase cost per system approx. $300,000.	This option is not adopted as the minimal environmental benefit gained is disproportionate to the cost and complexity of its implementation.	No
Use of Autonomous Underwater Vehicles (AUVs) for hydrocarbon presence and detection.	Use of AUVs may be feasible and may provide an environmental benefit in assessing inaccessible areas for presence of hydrocarbons in the water however cost of purchase is disproportionate to the environmental benefit when compared to the monitoring types in place.	AUVs may be considered as an additional method of monitoring, should remote systems be required for health and safety reasons.	Cost $10,000 for mobilisation and $15,000 a day when deployed.	This option is not adopted as other monitoring techniques already in place meet the need and have lower implementation costs.	No

6.1.1.2 Additional Control Measures

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Additional personnel trained to use systems.	Current arrangement provides an environmental benefit in the availability of trained personnel facilitating access to monitoring data used to inform all other response techniques. No improvement required.	No improvement can be made, all personnel in technical roles e.g. intelligence unit are trained and competent on the software systems. Personnel are trained and exercised regularly. Use of the software and systems forms part of regular work assignments and projects.	Cost for training in-house staff would be approx. $25,000.	This option is not adopted as the current capability meets the need.	No
Additional satellite tracking buoys to enable greater area coverage.	Increased capability does not provide an environmental benefit compared to the disproportionate cost in having an additional contract in place.	Tracking buoy on location at manned facility, additional needs are met from Woodside owned stocks in King Bay Support Base (KBSB) and Exmouth or can be provided by service provider.	Cost for an additional satellite tracking buoy would be $200 per day or $6,000 to purchase.	This option is not adopted as the current capability meets the need, but additional units are available if required.	No
Additional trained aerial observers.	Woodside has access to a pool of trained, competent observers at strategic locations to ensure timely and sustainable response. Additional observers are available through current contracts with AMOSC and OSRL.	Aviation standards & guidelines ensure all aircraft crews are competent for their roles. Woodside maintains a pool of trained and competent aerial observers with various home base locations to be called upon at the time of an incident. Regular audits of oil spill response organisations ensure training and competency is maintained.	Cost for additional trained aerial observers would be $2,000 per person per day.	This option is not adopted as the current capability meets the need, but additional observers are available via response contractors if required.	No

6.1.1.3 Improved Control Measures

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Faster turnaround time from modelling contractor.	Improved control measure does not provide an environmental benefit compared to the disproportionate cost in having an additional contract in place.	External contractor on ICC roster to be called as soon as required. However initial information needs to be gathered by ICC team to request an accurate model. External	Modelling service with a faster activation time would be achieved via membership of an alternative modelling service at an annual cost of $50,000 for	This option is not adopted as the minimal environmental benefit gained is disproportionate to the cost	No

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
		contractor has person on call to respond from their own location.	24hr access plus an initial $5,000 per modelling run.	and complexity of its implementation.	
Night time aerial surveillance.	The risk of undertaking the aerial observations at night is disproportionate to the limited environmental benefit. The images would be of low quality and as such the variable is not adopted.	Flights will only occur when deemed safe by the pilot. The risk of night operations is disproportionate to the benefit gained, as images from sensors (IR, UV, etc). will be low quality. Flight time limitations will be adhered to.	No improvement can be made without risk to personnel health and safety and breaching Woodside's Golden Rules.	This option is not adopted as the safety considerations outweigh any environmental benefit gained.	No
Faster mobilisation time (for water quality monitoring).	Due to the restriction on accessing the spill location on Day one there is no environmental benefit in having vessels available from day one. The cost of having dedicated equipment and personnel is disproportionate to the environmental benefit. The availability of vessels and personnel meets the response need. Shortening the timeframes for vessel availability would require dedicated response vessels on standby in KBSB. The cost and organisational complexity of employing two dedicated response vessels (approximately $15M/year per vessel) is considered disproportionate to the potential environmental benefit to be realised by adopting this delivery options.	Operations are not feasible on day 1 as the hydrocarbon will take time to surface, and volatility has potential to cause health concerns within the first 24 hours of the response.	Cost for purchase of equipment approx. $200,000. Ongoing costs per annum for cost of hire and pre-positioning for life of asset/activity would be larger than the purchase cost. Dedicated equipment and personnel, living locally and on short notice to mobilise. The cost would be approx. $1M per annum, which is disproportionate to the incremental benefit this would provide, assets are already available on day 1. 2 integrated fleet vessels are available from day 1, however these could be tasked with other operations.	This option is not adopted as the area could not be accessed earlier due to safety considerations. Additionally, the cost and complexity of implementation outweighs the benefits.	No

6.1.2 Selected Control Measures

Following review of alternative, additional and improved control measures as outlined above, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.2 Source Control via Vessel SOPEP – ALARP Assessment

Alternative, Additional and Improved options have been assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.2.1 Source Control via Vessel SOPEP – Control Measure Options Analysis

6.2.1.1 Alternative control measures

Alternative Control Measures considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.1.2 Additional Control Measures

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.1.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.2 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.3 Oiled Wildlife Response – ALARP Assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.3.1 Existing Capability – Wildlife Response

Woodside's exiting level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.3.2 Oiled Wildlife Response – Control Measure Options Analysis

6.3.2.1 Alternative Control Measures

Alternative Control Measures Considered
Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control

Option considered	Environmental consideration	Feasibility	Approximate cost	Assessment conclusions	Implemented
Direct contracts with service providers	This option duplicates the capability accessed through AMOSC and OSRL and would compete for the same resources. It does not provide a significant increase in environmental benefit.	These delivery options provide increased effectiveness through more direct communication and control of specialists. However, no significant net benefit is anticipated.	Duplication of capability – already subscribed to through contracts with AMOSC and OSRL	This option is not adopted as the existing capability meets the need.	No

6.3.2.2 Additional Control Measures

Additional Control Measures Considered
Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures

Option considered	Environmental consideration	Feasibility	Approximate cost	Assessment conclusions	Implemented
Additional wildlife treatment systems	The selected delivery options provide access to call-off contracts with selected specialist providers. The agreements ensure that these resources can be mobilised to meet the required response objectives, commensurate with the progressive nature of environmental impact and the time available to monitor hydrocarbon plume trajectories. Current arrangements provide response equipment and personnel by Day 3. The additional cost in having a dedicated oiled wildlife response (equipment and personnel) in place is disproportionate to environmental benefit. The selected delivery options provide capacity to carry out an oiled wildlife response if contact is predicted; and to scale up the response if required to treat widespread contamination. Current capability meets the needs required and there is no additional environmental benefit in adopting the improvements.	Hydrocarbon contact is not predicted above threshold at any sensitive site. thus Additionally, the remote offshore location of the release site provides sufficient opportunity for the ongoing monitoring and surveillance operations to inform the scale of the response. Numbers of oiled wildlife are expected to be low due to the nature of the spill. Oiled wildlife response capacity would be addressed for open Commonwealth waters through the AMOSC arrangements, as informed by operational monitoring.	Additional wildlife response resources could total $1,700 per operational site per day. The cost of implementing measures to reduce the mobilisation time is considered disproportionate to the benefit.	This option is not adopted as the existing capability meets the need.	No
Additional trained wildlife responders	Current numbers meet the need and additional personnel are already available through existing contracts with oil spill response organisations and environmental panel contractors. Numbers of oiled wildlife are expected to be low in the remote offshore setting of the oiled wildlife response, given the distance from known aggregation areas. The potential environmental benefit of training additional personnel is expected to be low.	The capability meets the predicted need with additional capacity available from OSRL in the event that a response needed to be scaled up. Materials for holding facilities, portable pools, enclosures and rehabilitation areas would be sourced as required.	Additional wildlife response personnel cost $2,000 per person per day	This option is not adopted as the existing capability meets the need.	No

6.3.2.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Faster mobilisation time for wildlife response	Response time is limited by specialist personnel mobilisation time. Current timing is sufficient as there is no predicted contact of sensitive areas. This control measure provides increased effectiveness through faster mobilisation of specialists. However, no significant net environmental benefit is expected due to the lack of shoreline impact.	Pre-positioning vessels or equipment would reduce mobilisation time for oiled wildlife response activities. However, given the effectiveness of an oiled wildlife response is expected to be low, an earlier response would provide a marginal increase in environmental benefit. The selected delivery options meet the predicted need and exceed the estimated Level 1-2 oiled wildlife response thought to be applicable. This delivery option provides the maximum expertise pooled across the participating operators, backed up by the international resources provided by OSRL. The availability of vessels and personnel meets the response need.	Wildlife response packages to preposition at vulnerable sites identified through the deterministic modelling cost $700 per package per day. The cost of having dedicated equipment and personnel available to respond faster is considered disproportionate to the environmental benefit.	This option is not adopted as the existing capability meets the need.	No

6.3.3 Selected control measures

Following review of alternative, additional and improved control measures as outlined above, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.4 Waste Management – ALARP Assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.4.1 Existing Capability – Waste Management

Woodside's exiting level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, refuelling/restocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.4.2 Waste Management – Control Measure Options Analysis

6.4.2.1 Alternative Control Measures

Alternative Control Measures Considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
No reasonably practical alternative control measures identified.					

6.4.2.2 Additional Control Measures

Additional Control Measures Considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Increased waste storage capability	The procurement of waste storage equipment options on the day of the event will allow immediate response and storage of collected waste. The environmental benefit of immediate waste storage is to reduce ecological consequence by safely securing waste, allowing continuous response operations to occur.	Access to Veolia's storage options provides the resources required to store and transport sufficient waste to meet the need. Access to waste contractors existing facilities enables waste to be stockpiled and gradually processed within the regional waste handling facilities. Additional temporary storage equipment is available through existing contract and arrangements with OSRL. Existing arrangements meet identified need for the PAP.	Cost for increased waste disposal capability would be approx. \$1,300 per m^3. Cost for increased onshore temporary waste storage capability would be approx. \$40 per unit per day.	This option is not adopted as the existing capability meets the need.	No

6.4.2.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Faster response time	The environmental benefit from successful waste storage will reduce pressure on the treatment and disposal facilities reducing ecological consequences by safely securing waste. In addition, waste storage and transport will allow continuous response operations to occur. This delivery option would increase known available storage, eliminating the risk of additional resources not being available at the time of the event. However, the environmental benefit of Woodside procuring additional waste storage is considered minor as the risk of additional storage not being available at the time of the event is considered low and existing arrangements provide adequate storage to support the response.	Woodside already maintains an equipment stockpile in Exmouth to enable shorter response times to incidents. This stockpile includes temporary waste storage equipment. Woodside has access to stockpiles of waste storage and equipment in Dampier and Exmouth through existing contracts and arrangements.	The incremental benefit of having a dedicated local Woodside owned stockpile of waste equipment and transport is considered minor and cost is considered disproportionate to the benefit gained given predicted shoreline contact times.	This option is not adopted as the existing capability meets the need.	No

6.4.3 Selected control measures

Following review of alternative, additional and improved control measures as outlined above, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional

  - None selected
- Improved
  - None selected

6.5 Scientific Monitoring – ALARP Assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.5.1 Existing Capability – Scientific Monitoring

Woodside's existing level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, re-fuelling/re-stocking provisions, and other similar logistic and operational limitations that are beyond Woodside's direct control.

6.5.2 Scientific Monitoring – Control Measure Options Analysis

Table 6-1: Scientific Monitoring - Control Measure Options considered – A. alternative control measures

Evaluate Alternative, Additional and Improved Control Measures					
Alternative Control Measures considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*					
Ref	Control Measure Category	Option considered	Implemented	Environmental Consideration	Feasibility / Cost
SM01	System	Analytical laboratory facilities closer to the likely spill affected area	No	SM01 water quality monitoring requires water samples to be transported to NATA rated laboratories in Perth or interstate. Consider the benefit of laboratory access and transportation times to deliver water samples and complete lab analysis. There is a time lag from collection of water samples to being in receipt of results and confirming hydrocarbon contact to sensitive receptors). The environmental consideration of having access to suitable laboratory facilities in Exmouth or Karratha to carry out the hydrocarbon analysis would provide faster turnaround in reporting of results only by a matter of days (as per the time to transport samples to laboratories).	Laboratory facilities and staff available at locations closer to the spill affected area can reduce reporting times only to a moderate degree (days) with associated high costs of maintaining capability do not improve the environmental benefit.
SM01	System	Dedicated contracted SMP vessel (exclusive to Woodside)	No	Would provide faster mobilisation time of scientific monitoring resources, environmental benefit associated with faster mobilisation time would be minor compared to selected options.	Chartering and equipping additional vessels on standby for scientific monitoring has been considered. The option is reasonably practicable but the sacrifice (charter costs and organisational complexity) is significant, particularly when compared with the anticipated availability of vessels and resources within in the required timeframes. The selected delivery provides capability to meet the scientific monitoring objectives, including collection of pre-emptive data where baseline knowledge gaps are identified for receptor locations where spill predictions of time to contact are >10 days. The effectiveness of this alternative control (weather dependency, availability and survivability) is rated as very low The cost and organisational complexity of employing a dedicated response vessel is considered disproportionate to the potential environmental benefit by adopting these delivery options.

Table 6-2: Scientific Monitoring - Control Measure Options considered – B. Additional control measures

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
Ref	**Control Measure Category**	**Option considered**	**Implemented**	**Environmental Consideration**	**Feasibility / Cost**
SM01	System	Determine baseline data needs and provide implementation plan in the event of an unplanned hydrocarbon release	Yes	Address resourcing needs to collect post spill (pre-contact) baseline data as spill expands in the event of a loss of marine diesel from the PAP activities.	Woodside relies on existing environmental baseline for receptors which have predicted hydrocarbon contact (above environment threshold) <10 days and acquiring pre-emptive data in the event of a loss of marine diesel from the PAP activities based on receptors predicted to have hydrocarbon contact >10 days. Ensure there is appropriate baseline for key receptors for all geographic locations that are potentially impacted <10 days of spill event, where practicable. Address resourcing needs to collect pre-emptive baseline as spill expands in the event of a loss of marine diesel from the PAP activities.

6.5.3 Improved Control Measures

Improved Control Measures considered – No reasonably practicable improved Control Measures identified.

6.5.4 Selected Control Measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected.
- Additional
  - Determine baseline data needs and activate SMPs for any identified PBAs in the event of an unplanned hydrocarbon release.
- Improved
  - None Selected.

6.5.5 Operational Plan

Key actions from the Scientific Monitoring Program Operational Plan for implementing the response are outlined in Table 6-3: Scientific monitoring program operational plan actions.

Table 6-3: Scientific monitoring program operational plan actions

Responsibility	Action
Activation	
Perth ICC Planning (ICC Planning – Environment Unit)	Mobilises Chief Environmental Scientist or SMP Lead/Manager and SMP Coordinator to the ICC Planning function.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager and SMP Coordinator)	Constantly assesses all outputs from OM01, OM02 and OM03 (Section 5 and ANNEX B) to determine receptor locations and receptors at risk. Confirm sensitive receptors likely to be exposed to hydrocarbons, timeframes to specific receptor locations and which SMPs are triggered. Review baseline data for receptors at risk.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager and SMP Coordinator)	SMP co-ordinator stands up SMP standby contractor as the SMP contractor. Stands up subject matter experts, if required.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager SMP Coordinator, SMP standby contractor SMP manager)	Establish if, and where, pre-contact baseline data acquisition is required. Determines practicable baseline acquisition program based on predicted timescales to contact and anticipated SMP mobilisation times. Determines scope for preliminary post-contact surveys during the Response Phase. Determines which SMP activities are required at each location based on the identified receptor sensitivities.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP standby contractor SMP manager)	If response phase data acquisition is required, stand up the contractor SMP teams for data acquisition and instruct them to standby awaiting further details for mobilisation from the IMT.
Perth ICC Planning (ICC Planning – Environment Unit)	SMP contractor, SMP standby contractor to prepare the Field Implementation Plan. Prepare and obtain sign-off of the Response Phase SMP work plan and Field Implementation Plan.

Responsibility	Action
(SMP Lead/Manager, SMP Coordinator, SMP standby contactor SMP manager)	Update the IAP.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator SMP standby contactor SMP manager)	Liaise with ICC Logistics, and determine the status and availability of aircraft, vessels and road transportation available to transport survey personnel and equipment to point of departure. Engage with SMP standby contactor SMP Manager and ICC Logistics to establish mobilisation plan, secure logistics resources and establish ongoing logistical support operations, including: • Vessels, vehicles and other logistics resources • Vessel fit-out specifications (as detailed in the SMP Operational Plan) • Equipment storage and pick-up locations • Personnel pick-up/airport departure locations • Ports of departure • Land based operational centres and forward operations bases accommodation and food requirements.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP standby contactor (SMP manager)	Confirm communications procedures between Woodside SMP team, SMP standby contactor SMP Manager, SMP Team Leads and Operations Point Coordinator.
Mobilisation	
Perth ICC Logistics	Engage vessels and vehicles and arrange fitting out as specified by the mobilisation Plan Confirm vessel departure windows and communicate with the Jacob's SMP Manager. Agree SMP mobilisation timeline and induction procedures with the Division and Sector Command Point(s).
Perth ICC Logistics	Coordinate with SMP standby contactor SMP Manager to mobilise teams and equipment according to the logistics plan and Sector induction procedures.
SMP Survey Team Leads	SMP Survey Team Leader(s) coordinate on-ground/on-vessel mobilisations and support services with the Sector Command point(s).

6.5.6 ALARP and Acceptability Summary

<table>
<tr><th colspan="3">ALARP and Acceptability Summary</th></tr>
<tr><td colspan="3">Scientific Monitoring</td></tr>
<tr><td rowspan="4">ALARP Summary</td><td>X</td><td>All known reasonably practicable control measures have been adopted</td></tr>
<tr><td>X</td><td>No additional, alternative and improved control measures would provide further benefit</td></tr>
<tr><td>X</td><td>No reasonably practical additional, alternative, and/or improved control measure exists</td></tr>
<tr><td colspan="2">The resulting scientific monitoring capability has been assessed against the worst-case credible spill scenarios. The range of strategies provide an ongoing approach to monitoring operations to assess and evaluate the scale and extent of impacts.

All known reasonably practicable control measures have been adopted with the cost and organisational complexity of these options determined to be Moderate and the overall delivery effectiveness considered Medium. The SMP’s main objectives can be met, with the addition of one alternative control measures to provide further benefit.</td></tr>
<tr><td>Acceptability Summary</td><td colspan="2">• The control measures selected for implementation manage the potential impacts and risks to ALARP.
• In the event of a hydrocarbon spill for the PAP, the control measures selected, meet or exceed the requirements of Woodside Management System and industry best-practice.
• Throughout the PAP, relevant Australian standards and codes of practice will be followed to evaluate the impacts from a loss of marine diesel.
• The level of impact and risk to the environment has been considered with regard to the principles of Environmentally Sustainable Development (ESD); and risks and impacts from a range of identified scenarios were assessed in detail. The control measures described consider the conservation of biological and ecological diversity, through both the selection of control measures and the management of their performance. The control measures have been developed to account for the worst-case credible case scenarios, and uncertainty has not been used as a reason for postponing control measures.</td></tr>
<tr><td colspan="3">On the basis from the impact assessment above and in Section 6 of the EP Woodside considers the adopted controls discussed manage the impacts and risks associated with implementing scientific monitoring activities to a level that is ALARP and acceptable.</td></tr>
</table>

7 ENVIRONMENTAL RISK ASSESSMENT OF SELECTED RESPONSE TECHNIQUES

The implementation of response techniques may modify the impacts and risks identified in the EP and response activities can introduce additional impacts and risks from response operations themselves. Therefore, it is necessary to complete an assessment to ensure these impacts and risks have been considered and specific measures are put in place to continually review and manage these further impacts and risks to ALARP and Acceptable levels. A simplified assessment process has been used to complete this task which covers the identification, analysis, evaluation and treatment of impacts and risks introduced by responding to the event.

7.1 Identification of impacts and risks from implementing response techniques

Each of the control measures can modify the impacts and risks identified in the EP. These impacts and risks have been previously assessed within the scope of the EP. Refer to the EP for details regarding how these risks are being managed. They are not discussed further in this document.

- atmospheric emissions
- routine and non-routine discharges
- physical presence, proximity to other vessels (shipping and fisheries)
- routine acoustic emissions vessels
- lighting for night work/navigational safety
- invasive marine species
- collision with marine fauna
- disturbance to seabed.

Additional impacts and risks associated with the control measures not included within the scope of the EP include:

- vessel operations and anchoring
- human presence
- waste generation
- additional stress or injury caused to wildlife.

7.2 Analysis of impacts and risks from implementing response techniques

The table below compares the adopted control measures for this activity against the environmental values that can be affected when they are implemented.

Table 7-1: Analysis of risks and impacts

	Environmental Value						
	Soil & Groundwater	**Marine Sediment Quality**	**Water Quality**	**Air Quality**	**Ecosystems/ Habitat**	**Species**	**Socio-Economic**
Monitor and evaluate		✓	✓		✓	✓	
Source control on the vessel		✓	✓	✓	✓	✓	✓
Oiled Wildlife					✓	✓	
Scientific Monitoring	✓	✓	✓	✓	✓	✓	✓
Waste Management	✓	✓		✓	✓	✓	✓

7.3 Evaluation of impacts and risks from implementing response techniques

Vessel operations and anchoring

During the implementation of response techniques, where water depths allow, it is possible that response vessels will be required to anchor (e.g. during shoreline surveys). The use of vessel anchoring will be minimal and likely to occur when the impacted shoreline is inaccessible via road. Anchoring in the nearshore environment of sensitive receptor locations will have the potential to impact coral reef, seagrass beds and other benthic communities in these areas. Recovery of benthic communities from anchor damage depends on the size of anchor and frequency of anchoring. Impacts would be highly localised (restricted to the footprint of the vessel anchor and chain) and temporary, with full recovery expected.

Human presence

Human presence for shoreline assessment or oiled wildlife response may lead to the compaction of sediments and damage to the existing environment especially in sensitive locations such as mangroves and turtle nesting beaches. However, any impacts are expected to be localised with full recovery expected.

Waste generation

Implementing the selected response techniques will result in the generation of the following waste streams that will require management and disposal:

- liquids (recovered oil/water mixture), recovered from oiled wildlife response operations
- semi-solids/solids (oily solids), collected during oiled wildlife response operations
- debris (e.g. seaweed, sand, woods, plastics), collected during oiled wildlife response.

If not managed and disposed of correctly, wastes generated during the response have the potential for secondary contamination similar to that described above, impacts to wildlife through contact with or ingestion of waste materials and contamination risks if not disposed of correctly onshore.

Additional stress or injury caused to wildlife

Additional stress or injury to wildlife could be caused through the following phases of a response:

- capturing wildlife
- transporting wildlife
- stabilisation of wildlife
- cleaning and rinsing of oiled wildlife

- rehabilitation (e.g. diet, cage size, housing density)
- release of treated wildlife

Inefficient capture techniques have the potential to cause undue stress, exhaustion or injury to wildlife, additionally pre-emptive capture could cause undue stress and impacts to wildlife when there are uncertainties in the forecast trajectory of the spill. During the transportation and stabilisation phases there is the potential for additional thermoregulation stress on captured wildlife. Additionally, during the cleaning process, it is important personnel undertaking the tasks are familiar with the relevant techniques to ensure that further injury and the removal of water proofing feathers are managed and mitigated. Finally, during the release phase it's important that wildlife is not released back into a contaminated environment.

7.4 Treatment of impacts and risks from implementing response techniques

In respect of the impacts and risks assessed the following treatment measures have been adopted. It must be recognised that this environmental assessment is seeking to identify how to maintain the level of impact and risks at levels that are ALARP and of an acceptable level rather than exploring further impact and risk reduction. It is for this reason that the treatment measures identified in this assessment will be captured in Operational Plans, TRPs, and/or the FSP.

Vessel operations and access in the nearshore environment

- Where existing fixed anchoring points are not available, locations will be selected to minimise impact to nearshore benthic environments with a preference for areas of sandy seabed where they can be identified (PS 8.1).
- Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines (PS 8.2).

Human presence

- Shoreline access route (foot, car, vessel and helicopter) with the least environmental impact identified will be selected by a specialist in SCAT operations (PS 7.3).

Waste generation

- All oiled wildlife response sites zoned and marked before operations commence to prevent secondary contamination and minimise the mixing of clean and oiled waste (PS 11.1)

Additional stress or injury caused to wildlife

- Oiled wildlife operations (including hazing) would be implemented with advice and assistance from the Oiled Wildlife Advisor from the DBCA and in accordance with the processes and methodologies described in the WA OWRP and the relevant regional plan (PS 10.3).

8 ALARP CONCLUSION

An analysis of alternative, additional and improved control measures has been undertaken to determine their reasonableness and practicability. The tables in Section 6 document the considerations made in this evaluation. Where the costs of an alternative, additional, or improved control measure has been determined to be clearly disproportionate to the environmental benefit gained from its adoption it has been rejected. Where this is not considered to be the case the control measure has been adopted.

The risks from a hydrocarbon spill have been reduced to ALARP because:

- Woodside has a significant hydrocarbon spill response capability to respond to the WCCS through the control measures identified.
- New and modified impacts and risks associated with implementing response techniques have been considered and will not increase the risks associated with the activity.
- A consideration of alternative, additional, and improved control measures identified any other control measures that delivered proportionate environmental benefit compared to the cost of adoption for this activity ensuring that:
    - All known, reasonably practicable control measures have been adopted.
    - No additional, reasonably practicable alternative and/or improved control measures would provide further environmental benefit.
    - No reasonably practical additional, alternative, and/or improved control measure exists.
- A structured process for considering alternative, additional, and improved control measures was completed for each control measure.
- The evaluation was undertaken based on the outputs of the WCCS so that the capability in place is sufficient for any other scenario arising from this activity.
- The likelihood of the WCCS spill has been ignored in evaluating what was reasonably practicable.

9 ACCEPTABILITY CONCLUSION

Following the ALARP evaluation process, Woodside deems the hydrocarbon spill risks and impacts to have been reduced to an acceptable level by meeting all of the following criteria:

- Techniques are consistent with Woodside's processes and relevant internal requirements including policies, culture, processes, standards, structures and systems.
- Levels of risk/ impact are deemed acceptable by relevant persons (external stakeholders) and are aligned with the uniqueness of, and/or the level of protection assigned to the environment, its sensitivity to pressures introduced by the activity, and the proximity of activities to sensitive receptors, and have been aligned with Part 3 of the EPBC Act.
- Selected control measures meet requirements of legislation and conventions to which Australia is a signatory (e.g. MARPOL, the World Heritage Convention, the Ramsar Convention, and the Biodiversity Convention etc.). In addition to these, other non-legislative requirements met include:
    - Australian IUCN reserve management principles for Commonwealth marine protected areas and bioregional marine plans.
    - National Water Quality Management Strategy and supporting guidelines for marine water quality).
    - Conditions of approval set under other legislation.
    - National and international requirements for managing pollution from ships.
    - National biosecurity requirements.
- Industry standards, best practices and widely adopted standards and other published materials have been used and referenced when defining acceptable levels. Where these are inconsistent with mandatory/ legislative regulations, explanation has been provided for the proposed deviation. Any deviation produces the same or a better level of environmental performance (or outcome).

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11 GLOSSARY & ABBREVIATIONS

11.1 Glossary

Term	Description / Definition
ALARP	Demonstration through reasoned and supported arguments that there are no other practicable options that could reasonably be adopted to reduce risks further.
Availability	The availability of a control measure is the percentage of time that it is capable of performing its function (operating time plus standby time) divided by the total period (whether in service or not). In other words, it is the probability that the control has not failed or is undergoing a maintenance or repair function when it needs to be used.
Control	The means by which risk from events is eliminated or minimised.
Control effectiveness	A measure of how well the control measures perform their required function.
Control measure (risk control measure)	The features that eliminate, prevent, reduce or mitigate the risk to environment associated with PAP.
Credible spill scenario	A spill considered by Woodside as representative of maximum volume and characteristics of a spill that could occur as part of the PAP.
Dependency	The degree of reliance on other systems in order for the control measure to be able to perform its intended function.
Environment that may be affected	The summary of quantitative modelling where the marine environment could be exposed to hydrocarbons levels exceeding hydrocarbon threshold concentrations.
Incident	An event where a release of energy resulted in or had (with) the potential to cause injury, ill health, damage to the environment, damage to equipment or assets or company reputation.
Major Environment Event	The events with potential environment, reputation, social or cultural consequences of category C or higher (as per Woodside's operational risk matrix) which are evaluated against credible worst-case scenarios which may occur when all controls are absent or have failed.
Performance outcome	A statement of the overall goal or outcome to be achieved by a control measure
Performance standard	The parameters against which [risk] controls are assessed to ensure they reduce risk to ALARP. A statement of the key requirements (indicators) that the control measure has to achieve in order to perform as intended in relation to its functionality, availability, reliability, survivability and dependencies.
Preparedness	Measures taken before an incident in order to improve the effectiveness of a response
Reasonably practicable	... a computation ... made by the owner, in which the quantum of risk is placed on one scale and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) [showing whether or not] that there is a gross disproportion between them ... made by the owner at a point of time anterior to the accident. (Judgement: Edwards v National Coal Board [1949])
Receptors at risk	Physical, biological and social resources identified as at risk from hydrocarbon contact using oil spill modelling predictions.
Receptor areas	Geographically referenced areas such as bays, islands, coastlines and/or protected area (WHA, Commonwealth or State marine reserve or park) containing one or more receptor type.

Term	Description / Definition
Receptor Sensitivities	This is a classification scheme to categorise receptor sensitivity to an oil spill. The Environmental Sensitivity Index (ESI) is a numerical classification of the relative sensitivity of a particular environment (particularly different shoreline types) to an oil spill. Refer to the Woodside OPEA for more details.
Regulator	NOPSEMA are the Environment Regulator under the Environment Regulations.
Reliability	The probability that at any point in time a control measure will operate correctly for a further specified length of time.
Response technique	The key priorities and objectives to be achieved by the response plan Measures taken in response to an event to reduce or prevent adverse consequences.
Survivability	Whether or not a control measure is able to survive a potentially damaging event is relevant for all control measures that are required to function after an incident has occurred.
Threshold	Hydrocarbon threshold concentrations applied to the risk assessment to evaluate hydrocarbon spills.
Zone of Application	The zone in which Woodside may elect to apply dispersant. The zone is determined based on a range of considerations, such as hydrocarbon characteristics, weathering and metocean conditions. The zone is a key consideration in the Net Environmental Benefit Analysis for dispersant use.

11.2 Abbreviations

Abbreviation	Meaning
AIIMS	Australasian Inter-Service Incident Management System
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
APASA	Asia Pacific Applied Science Associates
BAOAC	Bonn Agreement Oil Appearance Code
BOP	Blowout Preventer
CSt	Centistokes
CICC	Corporate Incident Coordination Centre
DM	Duty Manager
DBCA	Western Australia Department of Biodiversity, Conservation and Attractions (former Western Australian Department of Parks and Wildlife)
EMBA	Environment that May Be Affected
EMSA	European Maritime Safety Agency
EP	Environment Plan
Environment Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
ESI	Environmental Sensitivity Index
ESD	Environmentally Sustainable Development
ESP	Environmental Services Panel
FPSO	Floating Production Storage Offloading
FSP	First Strike Plan
GIS	Geographic Information System
IAP	Incident Action Plan
ICC	Incident Coordination Centre
IMT	Incident Management Team
IPIECA	International Petroleum Industry Environment Conservation Association
ISV	Infield support vessel
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
KBSF	King Bay Support Facility
MODU	Mobile Offshore Drilling Unit
MOU	Memorandum of Understanding
NEBA	Net Environmental Benefit Analysis
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
OILMAP	Oil Spill Model and Response System
OPEA	Oil Pollution Emergency Arrangements

Abbreviation	Meaning
OPEP	Oil Pollution Emergency Plan
OSCA	Oil Spill Cleaning Agent (registered for use within the National Plan)
OSRL	Oil Spill Response Limited
OSTM	Oil Spill Trajectory Modelling
OWRP	Oiled Wildlife Response Plan
OWROP	Regional Oiled Wildlife Response Operational Plan
PAP	Petroleum Activities Program
PBA	Pre-emptive Baseline Areas
PPB	Parts per billion
PPM	Parts per million
ROV	Remotely Operated Vehicle(s)
RPA	Response Protection Area
S&EM	Security & Emergency Management
SCAT	Shoreline Clean-up Assessment Technique
SDA	Surface Dispersant Application
SIMAP	Integrated Oil Spill Impact Model System
SSDI	Subsea Dispersant Injection
SFRT	Subsea First Response Toolkit
SMP	Scientific monitoring program
TRP	Tactical Response Plan
TSS	Total suspended solids
WA DoT	Western Australia Department of Transport
WHA	World Heritage Area
Woodside	Woodside Energy Limited
WWCI	Wild Well Control Inc
WCCS	Worst Case Credible Scenario
ZoA	Zone of Application

ANNEX A: NET ENVIRONMENTAL BENEFIT ANALYSIS DETAILED OUTCOMES

A pre-operational NEBA has been conducted to assess the net environmental benefit of different response techniques to selected receptors in the event of a marine diesel spill caused by a vessel collision during PAP activities. The complete list of potential receptor locations within the EMBA within the PAP is included in Section 6 of the EP.

With the exception of a surface contact of >50 g/m^2 at Montebello Marine Park, there were no other impacts predicted to RPAs above the threshold concentrations (surface contact >50 g/m^2 or shoreline accumulation of 100 g/m^2) to undertake most response techniques from the selected spill modelling and thus many of the response techniques are not feasible. The locations utilised for the NEBA below were based on receptors closest to the PAP site.

The detailed NEBA assessment outcomes are shown below.

The WA-49-L Gemtree Anchor Hold Testing preoperational NEBA contains the full assessments.

Table A-1: NEBA assessment technique recommendations for marine diesel (surface release from vessel collision)

Receptor	Monitor and Evaluate	Source Control via Vessel SOPEP	Containment and Recovery	In-situ burning	Dispersant application: >20 m water depth and >10 km from shore/reefs	Mechanical dispersion	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response
Ningaloo Coast (North/North West Cape, Middle and South) (WHA, and State Marine Park)	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Montebello Marine Park	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Montebello Islands and State Marine Park	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Barrow Island	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Lowendal Islands	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Argo-Rowley Terrace CMR	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Muiron Islands WHA & SMP	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Rankin Bank	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Glomar Shoals	Yes	Yes	No	No	No	No	No	No	No	No	Yes
Commonwealth waters	Yes	Yes	No	No	No	No	No	No	No	No	Yes

Overall assessment

Sensitive receptor (sites identified in EP)	Monitor and Evaluate	Source Control via Vessel SOPEP	Containment and Recovery	In-situ burning	Dispersant application: >20 m water depth and >10 km from shore/reefs	Mechanical dispersion	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response
Is this response practicable?	Yes	Yes	No	No	No	No	No	No	No	No	Yes
NEBA identifies response potentially of net environmental benefit?	Yes	Yes	No	No	No	No	No	No	No	No	Yes

NEBA Impact Ranking Classification Guidance

To reduce variability between assessments, the following ranking descriptions have been devised to guide the workshop process:

			Degree of impact	Potential duration of impact	Equivalent Woodside Corporate Risk Matrix Consequence Level
Positive	**3P**	**Major**	Likely to prevent: • behavioural impact to biological receptors • behavioural impact to socio-economic receptors e.g. changes to day-today business operations, public opinion/behaviours (e.g. avoidance of amenities such as beaches) or regulatory designations.	Decrease in duration of impact by >5 years	N/A
	2P	**Moderate**	Likely to prevent: • significant impact to a single phase of reproductive cycle of biological receptors • detectable financial impact, either directly (e.g. loss of income) or indirectly (e.g. via public perception), for socio-economic receptors.	Decrease in duration of impact by 1–5 years	N/A
	1P	**Minor**	Likely to prevent impacts on: • significant proportion of population or breeding stages of biological receptors • socio-economic receptors such as: ○ significant impact to the sensitivity of protective designation; or ○ significant and long-term impact to business/industry.	Decrease in duration of impact by several seasons (< 1 year)	N/A
	0	**Non-mitigated spill impact**	**No detectable difference to unmitigated spill scenario.**		
Negative	**1N**	**Minor**	Likely to result in: • behavioural impact to biological receptors • behavioural impact to socio-economic receptors e.g. changes to day-to-day business operations, public opinion/behaviours (e.g. avoidance of amenities such as beaches), or regulatory designations. **[Note 1]**	Increase in duration of impact by several seasons (< 1 year)	Increase in risk by one sub-category, without changing category (e.g. Minor (E) to Minor (D))
	2N	**Moderate**	Likely to result in: • significant impact to a single phase of reproductive cycle for biological receptors; or • detectable financial impact, either directly (e.g. loss of income) or indirectly (e.g. via public perception), for socio-economic receptors. This level of negative impact is recoverable and unlikely to result in closure of business/industry in the region.	Increase in duration of impact by 1–5 years	Increase in risk by one category (e.g. Minor (D) to Moderate (C or B))
	3N	**Major**	Likely to result in impacts on: • significant proportion of population or breeding stages of biological receptors • socio-economic receptors resulting in either: ○ significant impact to the sensitivity of protective designation; or ○ significant and long-term impact to business/industry.	Increase in duration of impact by >5 years or unrecoverable	Increase in risk by two categories (e.g. Minor (E) to Major (A))

NOTE: the maximum likely impact should be considered; for example, if a spill were to directly impact the behaviour that results in an impact to reproduction and/or the breeding population (such as fish failing to aggregate to spawn), then the score should be a 2 or 3 rather than a 1. Similarly, if a change in behaviour resulted in an increased risk of mortality of a population, then it should be scored as a 2 or 3.

ANNEX B: OPERATIONAL MONITORING ACTIVATION AND TERMINATION CRITERIA

Table B-1: Operational monitoring objectives, triggers and termination criteria

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational Monitoring Operational Plan 1 (OM01) Predictive Modelling of Hydrocarbons to Assess Resources at Risk	OM01 focuses on the conditions that have prevailed since a spill commenced, as well as those that are forecasted in the short term (1–3 days ahead) and longer term. OM01 utilises computer-based forecasting methods to predict hydrocarbon spill movement and guide the management and execution of spill response operations to maximise the protection of environmental resources at risk. The objectives of OM01 are to: • Provide forecasting of the movement and weathering of spilled hydrocarbons • Identify resources that are potentially at risk of contamination • Provide simulations showing the outcome of alternative response options (booming patterns etc.) to inform on-going Net Environmental Benefit Analysis (NEBA) and continually assess the efficacy of available response options in order to reduce risks to ALARP	OM01 will be triggered immediately following a level 2/3 hydrocarbon spill.	The criteria for the termination of OM01 are: • The hydrocarbon discharge has ceased and no further surface oil is visible • Response activities have ceased • Hydrocarbon spill modelling (as verified by OM02 surveillance observations) predicts no additional natural resources will be impacted

Operational Monitoring <u>Operational Plan</u>	Objectives	Activation triggers	Termination criteria
<u>Operational Monitoring Operational Plan 2 (OM02)</u> Surveillance and reconnaissance to detect hydrocarbons and resources at risk	OM02 aims to provide regular, on-going hydrocarbon spill surveillance throughout a broad region, in the event of a spill. The objectives of OM02 are: • Verify spill modelling results and recalibrate spill trajectory models (OM01). • Understand the behaviour, weathering and fate of surface hydrocarbons. • Identify environmental receptors and locations at risk or contaminated by hydrocarbons. • Inform ongoing Net Environmental Benefit Analysis (NEBA) and continually assess the efficacy of available response options in order to reduce risks to ALARP. • To aid in the subsequent assessment of the short- to long-term impacts and/or recovery of natural resources (assessed in SMPs) by ensuring that the visible cause and effect relationships between the hydrocarbon spill and its impacts to natural resources have been observed and recorded during the operational phase.	OM02 will be triggered immediately following a level 2/3 hydrocarbon spill.	The termination triggers for the OM02 are: • 72 hours has elapsed since the last confirmed observation of surface hydrocarbons. • Latest hydrocarbon spill modelling results (OM01) do not predict surface exposures at visible levels.
<u>Operational Monitoring Operational Plan 3 (OM03)</u> Monitoring of hydrocarbon presence, properties, behaviour and weathering in water	OM03 will measure surface, entrained and dissolved hydrocarbons in the water column to inform decision-making for spill response activities. The specific objectives of OM03 are as follows: • Detect and monitor for the presence, quantity, properties, behaviour and weathering of surface, entrained and dissolved hydrocarbons. • Verify predictions made by OM01 and observations made by OM02 about the presence and extent of hydrocarbon contamination. Data collected in OM03 will also be used for the purpose of longer-term water quality monitoring during SM01.	OM03 will be triggered immediately following a level 2/3 hydrocarbon spill.	The criteria for the termination of OM03 are as follows: • The hydrocarbon release has ceased. • Response activities have ceased. • Concentrations of hydrocarbons in the water are below available ANZECC/ ARMCANZ (2018) trigger values for 99% species protection.

Operational Monitoring Operational Plan	**Objectives**	**Activation triggers**	**Termination criteria**
Operational Monitoring Operational Plan 4 (OM04) Pre-emptive assessment of sensitive receptors at risk	OM04 aims to undertake a rapid assessment of the presence, extent and current status of shoreline sensitive receptors prior to contact from the hydrocarbon spill, by providing categorical or semi-quantitative information on the characteristics of resources at risk. The primary objective of OM04 is to confirm understanding of the status and characteristics of environmental resources predicted by OM01 and OM02 to be at risk, to further assist in making decisions on the selection of appropriate response actions and prioritisation of resources. Indirectly, qualitative/semi-quantitative pre-contact information collected by OM04 on the status of environmental resources may also aid in the verification of environmental baseline data and provide context for the assessment of environmental impacts, as determined through subsequent SMPs. OM04 would be undertaken in liaison with WA DoT as the control agency once the oil is in State Waters (if a Level 2/3 incident).	Triggers for commencing OM04 include: • Contact of a sensitive habitat or shoreline is predicted by OM01, OM02 and/or OM03. • The pre-emptive assessment methods can be implemented before contact from hydrocarbons (once a receptor has been contacted by hydrocarbons it will be assessed under OM05).	The criteria for the termination of OM04 at any given location are: • Locations predicted to be contacted by hydrocarbons have been contacted. • The location has not been contacted by hydrocarbons and is no longer predicted to be contacted by hydrocarbons (resources should be reallocated as appropriate).

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational monitoring operational plan 5 (OM05) Monitoring of contaminated resources	OM05 aims to implement surveys to assess the condition of fauna and habitats contacted by hydrocarbons at sensitive habitat and shoreline locations. The primary objectives of OM05 are: • Record evidence of oiled fauna (mortalities, sub-lethal impacts, number, extent, location) and habitats (mortalities, sub-lethal impacts, type, extent of cover, area, hydrocarbon character, thickness, mass and content) throughout the response and clean-up at locations contacted by hydrocarbons to inform and prioritise clean-up efforts and resources, while minimising the potential impacts of these activities. Indirectly, the information collected by OM05 may also support the assessment of environmental impacts, as determined through subsequent SMPs. OM05 would be undertaken in liaison with WA DoT as the control agency once the oil is in State Waters (if a Level 2/3 incident).	OM05 will be triggered when a sensitive habitat or shoreline is predicted to be contacted by hydrocarbons by OM01, OM02 and/or OM03.	The criteria for the termination of OM05 at any given location are: • No additional response or clean-up of wildlife or habitats is predicted. • Spill response and clean-up activities have ceased. OM05 survey sites established at sensitive habitat and shoreline locations will continue to be monitored during SM02. The formal transition from OM05 to SM02 will begin on cessation of spill response and clean-up activities.

ANNEX C: OIL SPILL SCIENTIFIC MONITORING PROGRAM

Oil Spill Environmental Monitoring

The following provides some further detail on Woodside's oil spill Scientific Monitoring Program and includes the following:

- The organisation, roles and responsibilities of the Woodside oil spill scientific monitoring team and external resourcing.
- A summary table of the ten scientific monitoring programs as per the specific focus receptor, objectives, activation triggers and termination criteria.
- Details on the oil spill environmental monitoring activation and termination decision-making processes.
- Baseline knowledge and environmental studies knowledge access via geo-spatial metadata databases.
- An outline of the reporting requirements for oil spill scientific monitoring programs.

Oil Spill Scientific Monitoring – Delivery Team Roles and Responsibilities

Woodside Oil Spill Scientific Monitoring Delivery Team

The Woodside science team are responsible for the delivery of the oil spill scientific monitoring. The roles and responsibilities of the Woodside scientific monitoring delivery team are presented in Table C-1 and the organisational structure and Incident Control Centre (ICC) linkage provided in Figure C-1.

Woodside Oil Spill Scientific monitoring program - External Resourcing

In the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors, scientific monitoring personnel and scientific equipment to implement the appropriate SMPs will be provided by standby SMP contractor who hold a standby contract for SMP via the Woodside Environmental Services Panel (ESP). In the event, that additional resources are required other consultancy capacity within the Woodside ESP will be utilised (as needed and may extend to specialist contractors such as research agencies engaged in long-term marine monitoring programs). In consultation with the standby SMP contractor and/or specialist contractors, the selection, field sampling and approach of the SMPs will be determined by the nature and scale of the spill.

Table C-1: Woodside and Environmental Service Provider – Oil Spill Scientific Monitoring Program Delivery Team Key Roles and Responsibilities

Role	Location	Responsibility
Woodside Roles		
SMP Lead/Manager	Onshore (Perth)	• Approves activated the SMPs based on operational monitoring data provided by the Planning Function • Provides advice to the ICC in relation to scientific monitoring • Provides technical advice regarding the implementation of scientific monitoring • Approves detailed sampling plans prepared for SMPs • Directs liaison between statutory authorities, advisors and government agencies in relation to SMPs.
SMP Co-ordinator	Onshore (Perth)	• Activates the SMPs based on operational monitoring data provided by the Planning Function • Sits in the Planning function of the ICC. • Liaises with other ICC functions to deliver required logistics, resources and operational support from Woodside to support the Environmental Service Provider in delivering on the SMPs. Acts as the conduit for advice from the Chief Environmental Scientist to the Environmental Service Provider • Manages the Environmental Service Provider's implementation of the SMPs • Liaises with the Environmental Service Provider on delivery of the SMPs • Arranges all contractual matters, on behalf of Woodside, associated with the Environmental Service Provider's delivery of the SMPs.

Role	Location	Responsibility
Environmental Service Provider Roles		
SMP Standby Contractor – SMP Duty Manager/Project Manager	Onshore (Perth)	• Coordinates the delivery of the SMPs • Provides costings, schedule and progress updates for delivery of SMPs • Determines the structure of the Environmental Service Provider's team to necessitate delivery of the SMPs • Verifies that HSE Plans, detailed sampling plans and other relevant deliverables are developed and implemented for delivery of the SMPs • Directs field teams to deliver SMPs • Arranges all contractual matters, on behalf of Environmental Service Provider, associated with the delivery of the SMPs to Woodside • Manages sub-consultant delivery to Woodside • Provides required personnel and equipment to deliver the SMPs.
SMP Field Teams	Offshore – Monitoring Locations	• Delivers the SMPs in the field consistent with the detailed sampling plans and HSE requirements, within time and budget. • Early communication of time, budget, HSE risks associated with delivery of the SMPs to the Environmental Service Provider – Project Manager • Provides start up, progress and termination updates to the Environmental Service Provider – Project Manager (will be led in-field by a party chief).

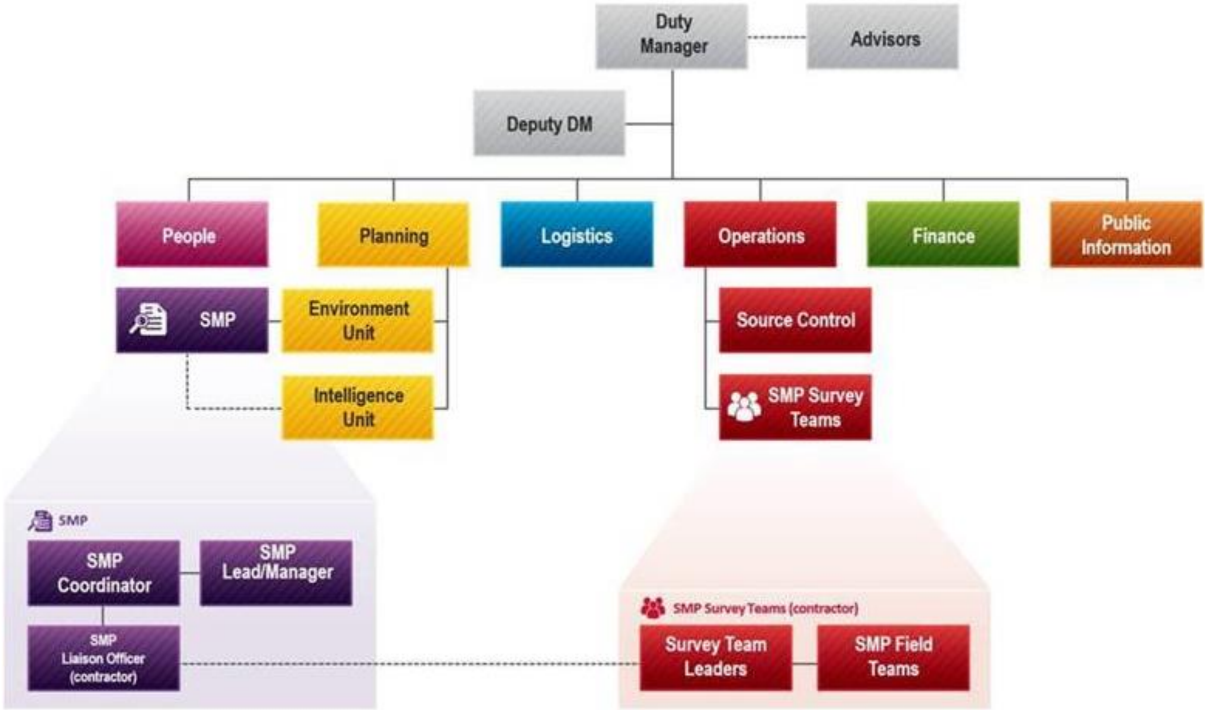

Figure C-1: Woodside Oil Spill Scientific Monitoring Program Delivery Team and Linkage to Incident Control Centre (ICC) organisational structure.

Table C-2: Oil Spill Environmental Monitoring: Scientific Monitoring Program - Objectives, Activation Triggers and Termination Criteria

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
Scientific monitoring program 1 (SM01) **Assessment of Hydrocarbons in Marine Waters**	SM01 will detect and monitor the presence, extent, persistence and properties of hydrocarbons in marine waters following the spill and the response. The specific objectives of SM01 are as follows: • Assess and document the extent, severity and persistence of hydrocarbon contamination with reference to observations made during surveillance activities and / or in-water measurements made during operational monitoring; and • Provide information that may be used to interpret potential cause and effect drivers for environmental impacts recorded for sensitive receptors monitored under other SMPs.	SM01 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors	SM01 will be terminated when: • Operational monitoring data relating to observations and / or measurements of hydrocarbons on and in water have been compiled, analysed and reported; and • The report provides details of the extent, severity and persistence of hydrocarbons which can be used for analysis of impacts recorded for sensitive receptors monitored under other SMPs. SMP monitoring of sensitive receptor sites: • Concentrations of hydrocarbons in water samples are below NOPSEMA guidance note (2019[7]) concentrations of 1 g/m^2 for floating, 10 ppb for entrained and dissolved; and • Details of the extent, severity and persistence of hydrocarbons from concentrations recorded in water have been documented at sensitive receptor sites monitored under other SMPs.
Scientific monitoring program 2 (SM02) **Assessment of the Presence, Quantity and Character of Hydrocarbons in Marine Sediments**	SM02 will detect and monitor the presence, extent, persistence and properties of hydrocarbons in marine sediments following the spill and the response. The specific objectives of SM02 are as follows: • Determine the extent, severity and persistence of hydrocarbons in marine sediments across selected sites where hydrocarbons were observed or recorded during operational monitoring; and • Provide information that may be used to interpret potential cause and effect drivers for environmental impacts recorded for sensitive receptors monitored under other SMPs.	SM02 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • Response activities have ceased; and • Operational monitoring results made during the response phase indicate that shoreline, intertidal or sub-tidal sediments have been exposed to surface, entrained or dissolved hydrocarbons (at or above 0.5 g/m^2 surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation).	SM02 will be terminated once pre-spill condition is reached and agreed upon as per the SMP termination criteria process and include consideration of: • Concentrations of hydrocarbons in sediment samples are below ANZECC/ ARMCANZ (2013[8]) sediment quality guideline values (SQGVs) for biological disturbance; and • Details of the extent, severity and persistence of hydrocarbons from concentrations recorded in sediments have been documented.
Scientific monitoring program 3 (SM03) **Assessment of Impacts and Recovery of Subtidal and Intertidal Benthos**	The objectives of SM03 are: • Characterize the status of intertidal and subtidal benthic habitats and quantify any impacts to functional groups, abundance and density that may be a result of the spill; and • Determine the impact of the hydrocarbon spill and subsequent recovery (including impacts associated with the implementation of response options). Categories of intertidal and subtidal habitats that may be monitored include: • Coral reefs • Seagrass • Macro-algae • Filter-feeders SM03 will be supported by sediment contamination records (SM02) and characteristics of the spill derived from OMPs.	SM03 will be activated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • As part of a pre-emptive assessment of PBAs of receptor locations identified by time to hydrocarbon contact >10 days, to target receptors and sites where it is possible to acquire pre-hydrocarbon contact baseline; and • Operational monitoring identified shoreline potential contact of hydrocarbons (at or above 0.5 g/m^2 surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation) for subtidal and intertidal benthic habitat.	SM03 will be terminated once pre-spill condition is reached and agreed upon as per the SMP termination criteria process and include consideration of: • Overall impacts to benthic habitats from hydrocarbon exposure have been quantified. • Recovery of impacted benthic habitats has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 4 (SM04) **Assessment of Impacts and Recovery of Mangroves / Saltmarsh**	The objectives of SM04 are: • Characterize the status of mangroves (and associated salt marsh habitat) at shorelines exposed/contacted by spilled hydrocarbons; • Quantify any impacts to species (abundance and density) and mangrove/saltmarsh community structure; and	SM04 will be activated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; and	SM04 will be terminated once pre-spill condition is reached and agreed upon as per the SMP termination criteria process and include consideration of: • Impacts to mangrove and saltmarsh habitat from hydrocarbon exposure have been quantified. • Recovery of impacted mangrove/saltmarsh habitat has been evaluated.

[7] NOPSEMA (2019) Bulletin #1 – Oil spill modelling – April 2019, https://www.nopsema.gov.au/assets/Bulletins/A652993.pdf
[8] Simpson SL, Batley GB and Chariton AA (2013). Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines. CSIRO and Water Science Report 08/07. Land and Water, pp. 132.

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
	• Determine and monitor the impact of the hydrocarbon spill and potential subsequent recovery (including impacts associated with the implementation of response options). SM03 will be supported by sediment sampling undertaken in SM02 and characteristics of the spill derived from OMPs.	• Operational monitoring identified shoreline potential contact of hydrocarbons (at or above 0.5 g/m^2 surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation) for mangrove/saltmarsh habitat.	• Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 5 (SM05) **Assessment of Impacts and Recovery of Seabird and Shorebird Populations**	The Objectives of SM05 are to: • Collate and quantify impacts to avian wildlife from results recorded during OM02 and OM05 (such as mortalities, oiling, rescue and release counts) and undertake a desk-based assessment to infer potential impacts at species population level; and • Undertake monitoring to quantify and assess impacts of hydrocarbon exposure to seabirds and shorebird populations at targeted breeding colonies / staging sites / important coastal wetlands where hydrocarbon contact was recorded.	SM05 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; • Operational monitoring predicts shoreline contact of hydrocarbons (at or above 0.5 g/m^2 surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation) at important bird colonies / staging sites / important coastal wetland locations; or • Records of dead, oiled or injured bird species made during the hydrocarbon spill or response.	SM05 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Impacts to seabird and shorebird populations from hydrocarbon exposure have been quantified. • Recovery of impacted seabird and shorebird populations has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 6 (SM06) **Assessment of Impacts and Recovery of Nesting Marine Turtle Populations**	The objectives of SM06 are to: • To quantify impacts of hydrocarbon exposure or contact on marine turtle nesting populations (including impacts associated with the implementation of response options); • Collate and quantify impacts to adult and hatchling marine turtles from results recorded during OM02 and OM05 (such as mortalities, oiling, rescue and release counts) and undertake a desk-based assessment to infer potential impacts at species population levels (including impacts associated with the implementation of response options); .and • Undertake monitoring to quantify and assess impacts of hydrocarbon exposure to nesting marine turtle populations at known rookeries (including impacts associated with the implementation of response options).	SM06 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring has: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; • Predicted shoreline contact of hydrocarbons (at or above 0.5 g/m^2 surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation) at known marine turtle rookery locations; or • Records of dead, oiled or injured marine turtle species made during the hydrocarbon spill or response.	SM06 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Impacts to nesting marine turtle populations from hydrocarbon exposure have been quantified. • Recovery of impacted nesting marine turtle populations has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 7 (SM07) **Assessment of Impacts to Pinniped Colonies including Haul-out Site Populations**	The objectives of SM07 are to: • Quantify impacts on pinniped colonies and haul-out sites as a result of hydrocarbon exposure/contact. • Collate and quantify impacts to pinniped populations from results recorded during OM02 and OM05 (such as mortalities, oiling, rescue and release counts) and undertake a desk-based assessment to infer potential impacts at species population levels.	SM07 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring has: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; • Identified shoreline contact of hydrocarbons ((at or above 0.5 g/m^2 surface, ≥5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation) at known pinniped colony or haul-out site(s) (i.e. most northern site is the Houtman Abrolhos Islands); or • Records of dead, oiled or injured pinniped species made during the hydrocarbon spill or response.	SM07 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Impacts to pinniped populations from hydrocarbon exposure have been quantified. • Recovery of pinniped populations has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 8 (SM08) **Desk-Based Assessment of Impacts to Other Non-Avian Marine Megafauna**	The objective of SM08 is to provide a desk-based assessment which collates the results of OM02 and OM05 where observations relate to the mortality, stranding or oiling of mobile marine megafauna species not addressed in SM06 or SM07, including: • Cetaceans; • Dugongs; • Whale sharks and other shark and ray populations; • Sea snakes; and • Crocodiles.	SM08 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring reports records of dead, oiled or injured non-avian marine megafauna during the spill/ response phase.	SM08 will be terminated when the results of the post-spill monitoring have quantified impacts to non-avian megafauna. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
	The desk-based assessment will include population analysis to infer potential impacts to marine megafauna species populations.		
Scientific monitoring program 9 (SM09) **Assessment of Impacts and Recovery of Marine Fish associated with SM03 habitats**	The objectives of SM09 are: • Characterise the status of resident fish populations associated with habitats monitored in SM03 exposed/contacted by spilled hydrocarbons; • Quantify any impacts to species (abundance, richness and density) and resident fish population structure (representative functional trophic groups); and • Determine and monitor the impact of the hydrocarbon spill and potential subsequent recovery (including impacts associated with the implementation of response options).	SM09 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented with SMO3.	SM09 will be undertaken and terminated concurrent with monitoring undertaken for SM03, as per the SMP termination criteria process • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 10 (SM10) **SM10 - Assessment of physiological impacts important fish and shellfish species (fish health and seafood quality/safety) and recovery**	SM10 aims to assess any physiological impacts to important commercial fish and shellfish species (assessment of fish health) and if applicable, seafood quality/safety. Monitoring will be designed to sample key commercial fish and shellfish species and analyse tissues to identify fish health indicators and biomarkers, for example: • Liver Detoxification Enzymes (ethoxyresorufin-O-deethylase (EROD) activity) • PAH Biliary Metabolites • Oxidative DNA Damage • Serum SDH • Other physiological parameters, such as condition factor (CF), liver somatic index (LSI), gonado-somatic index (GSI) and gonad histology, total weight, length, condition, parasites, egg development, testes development, abnormalities. Seafood tainting may be included (where appropriate) using applicable sensory tests to objectively assess targeted finfish and shellfish species for hydrocarbon contamination. Results will be used to make inferences on the health of commercial fisheries and the potential magnitude of impacts to fishing industries.	SM10 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring (OM01, OM02 and OM05) indicates the following: • The hydrocarbon spill will or has intersected with active commercial fisheries or aquaculture activities. • Commercially targeted finfish and/or shellfish mortality has been observed/recorded. • Commercial fishing or aquaculture areas have been exposed to hydrocarbons (≥0.5 g/m^2 surface and ≥5 ppb for entrained/dissolved hydrocarbons); and • Taste, odour or appearance of seafood presenting a potential human health risk is observed.	SM10 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Physiological impacts to important commercial fish and shellfish species from hydrocarbon exposure have been quantified. • Recovery of important commercial fish and shellfish species from hydrocarbon exposure has been evaluated. • Impacts to seafood quality/safety (if applicable) have been assessed and information provided to the relevant stakeholders and regulators for the management of any impacted fisheries. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.

Activation Triggers and Termination Criteria

Scientific monitoring program activation

The Woodside oil spill scientific monitoring team will be stood up immediately with the occurrence of a hydrocarbon spill (actual or suspected) Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors via the First Strike plan for the petroleum activity programme. The presence of any level of hydrocarbons in the marine environment triggers the activation of the oil spill scientific monitoring program (SMP). This is to ensure the full range of eventualities relating to the environmental, socio-economic and health consequences of the spill are considered in the planning and execution of the SMP. The activation process also takes into consideration the management objectives, species recovery plans, conservation advices and conservations plans for any World Heritage Area (WHA), AMPs, State Marine Parks, other protected area designations (e.g., State nature reserves) and Matters of National Environmental Significance (including listed species under part 3 of the EPBC Act) potentially exposed to hydrocarbons. With the first 24-48 hours of a spill event, such information will be sourced and evaluated as part of the SMP planning process guided by Appendix D (identified receptors vulnerable to hydrocarbon contact), the information presented in the Existing Environment section of the EP as well as other information sources such as the Woodside Baseline Environmental Studies Database.

The starting point for decision-making on which SMPs are activated, and the spatial extent of monitoring activities, will be based on the predictive modelling results (OM01) in the first 24-48 hours until more information is made available from other operational monitoring activities such as aerial surveillance and shoreline surveys. Pre-emptive Baseline Areas (WHA, AMPs and State Marine Parks encompassing key ecological and socio-economic values) are a key focus of the SMP activation decision-making process, particularly, in the early spill event/response phase. As the operational monitoring progresses and further situational awareness information becomes available, it will be possible to understand the nature and scale of the spill. The SMP activation and implementation decision-making will be revisited on a daily basis to account for the updates on spill information. One of the priority focus areas in the early phase of the incident will be to identify and execute pre-emptive SMP assessments at key receptor locations, as required. The SMP activation and implementation decision tree is presented in Figure C-2.

Scientific monitoring program termination

The basis of the termination process for the active SMPs (SMPs 1-10) will include quantification of impacts, evaluation of recovery for the receptor at risk and consultation with relevant authorities, persons and organisations. Termination of each SMP will not be considered until the results (as presented in annual SMP reports for the duration of each program) indicate that the target receptor has returned to pre-spill condition.

Once the SMP results indicate impacted receptor(s) have returned to pre-spill condition (as identified by Woodside) a termination decision-making process will be triggered and a number of steps will be undertaken as follows:

- Woodside will engage expert opinion on whether the receptor has returned to pre-spill condition (based on monitoring data). Subject Matter Expert (SMEs) will be engaged (via the Woodside SME scientific monitoring terms of reference to review program outcomes, provide expert advice and recommendations for the duration of each SMP.
- Where expert opinion agrees that the receptor has returned to pre-spill condition, findings will then be presented to the relevant authorities, persons and organisations (as defined by the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulation 11A). Stakeholder identification, planning and engagement will be managed by Woodside's Reputation Functional Support Team (FST) and follow the stakeholder management FST guidelines. These guidelines outline the FST roles and responsibilities, competencies, stakeholder communications and planning processes. An assessment of the merits of any objection to termination will be documented in the SMP final report.
- Woodside will decide on termination of SMP based on expert opinion and merits of any stakeholder objections. The final report following termination will include: monitoring results, expert opinion and stakeholder consultation including merits of any objections.
- Termination of SMPs will also consider applicable management objectives, species recovery plans, conservation advices and conservations plans for any World Heritage Area (WHA), AMPs,

State Marine Parks, other protected area designations (e.g., State nature reserves) and Matters of National Environmental Significance (including listed species under part 3 of the EPBC Act).

The SMP termination decision-making process will be applied to each active SMP and an iterative process of decision steps continued until each SMP has been terminated (refer to decision-tree diagram for SMP termination criteria, Figure C-3).

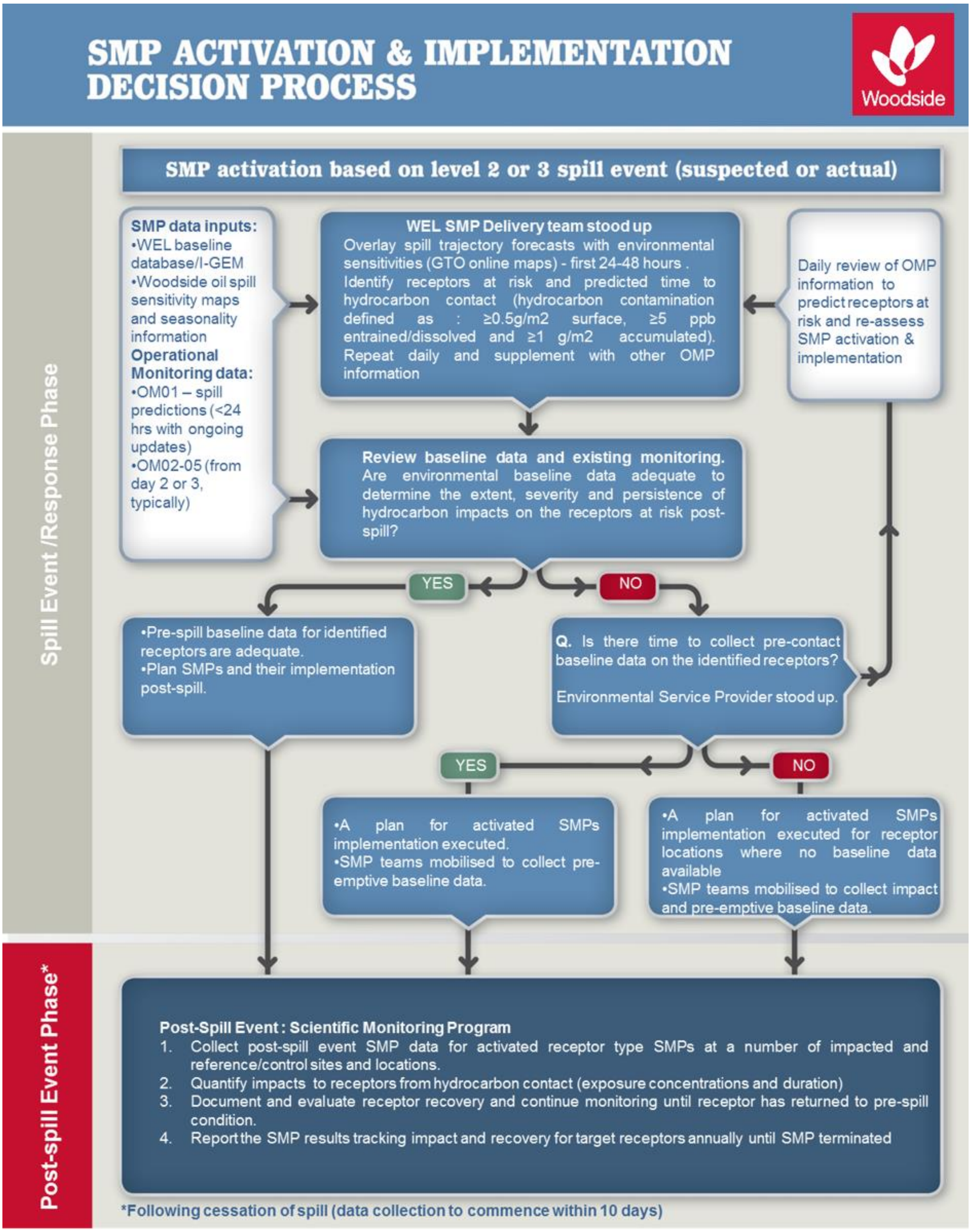

Figure C-2: Activation and Implementation Decision-tree for Oil Spill Environmental Monitoring

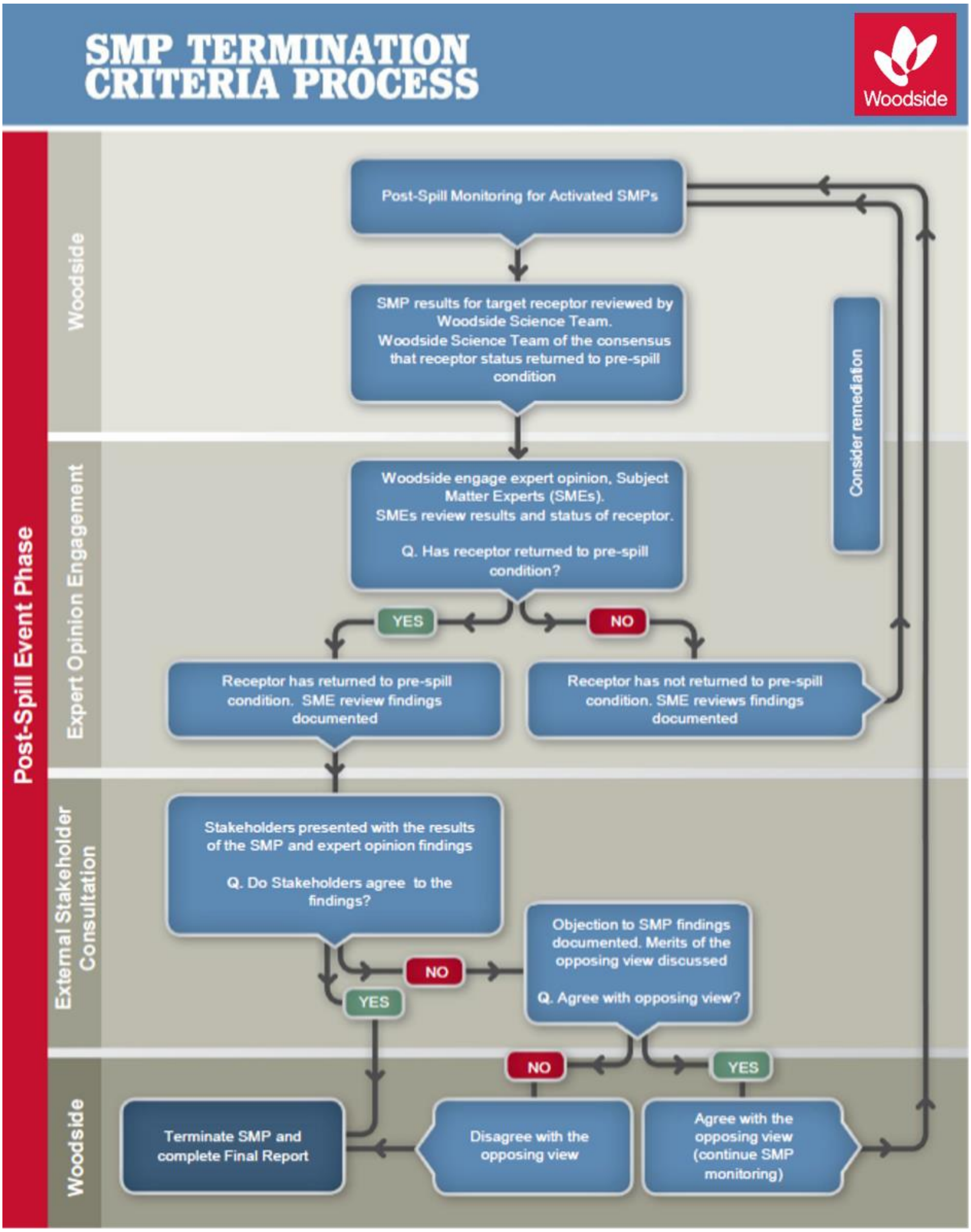

Figure C-3: Termination Criteria Decision-tree for Oil Spill Environmental Monitoring

Receptors at Risk and Baseline Knowledge

In order to assess the baseline studies available and suitability for oil spill scientific monitoring, Woodside maintains knowledge of environmental baseline studies through the upkeep and use of its Environmental Knowledge Management System.

Woodside’s Environmental Knowledge Management System is a centralised platform for scientific information on the existing environment, marine biodiversity, Woodside environmental studies, key environmental impact topics, key literature and web-based resources. The system comprises a number of data directories and an environmental baseline database, as well as folders within the ‘Corporate Environment’ server space. The environmental baseline database was set up to support Woodside’s SMP preparedness and as a SMP resource in the event of an unplanned hydrocarbon spill. The environmental baseline database is subject to updates including annual reviews completed as part of the contracted SMP standby, SMP standby contract. This database is accessed pre-PAP to identify Pre-emptive Baseline Areas (PBAs) where hydrocarbon contact is predicted to occur <10 days.

In addition to Woodside’s Environmental Knowledge Management System, it is acknowledged that many relevant baseline datasets are held by other organisations (e.g. other oil and gas operators, government agencies, state and federal research institutions and non-governmental organisations). In order to understand the present status of environmental baseline studies a spatial environmental metadata database for Western Australia (Industry-Government Environmental Metadata, I-GEM) was established. IGEM is a collaboration comprising oil and gas operators (including Woodside), government and research agencies and other organisations. The key objective of IGEM is for participating organisations to have the ability to identify quantitative marine baseline datasets available for species and habitats via a geo-spatially referenced metadata database. It provides members the ability to enter, view and filter metadata records on baseline studies as well as customise and generate report outputs. IGEM aims to provide a foundational baseline framework so industry and government can access the same knowledge base to understand baseline data in the event of an unplanned hydrocarbon release.

In the event of an unplanned hydrocarbon release, Woodside intends to interrogate the information on baseline studies status as held by the various databases (e.g. Woodside Environmental Knowledge Management System, IGEM and other sources of existing baseline data) to identify Pre-emptive Baseline Areas (PBAs), i.e., receptors at risk where hydrocarbon contact is predicted to be >10 days, and baseline data can be collected before hydrocarbon contact.

Reporting

For the scientific monitoring program relevant regulators will be provided with:

- Annual reports summarising the SMPs deployed and active, data collection activities and available findings; and
- Final reports for each SMP summarising the quantitative assessment of environmental impacts and recovery of the receptor once returned to pre-spill condition and termination of the monitoring program.

The reporting requirements of the scientific monitoring program will be specific to the individual SMPs deployed and terms of responsibilities, report templates, schedule, QA/QC and peer-review will be agreed with the contractors engaged to conduct the SMPs. Compliance and auditing mechanisms will be incorporated into the reporting terms.

ANNEX D: SCIENTIFIC MONITORING PROGRAM AND BASELINE STUDIES FOR THE PETROLEUM ACTIVITIES PROGRAM

Table D-1: Oil Spill Environmental Monitoring – scientific monitoring program scope for the Petroleum Activities Program based on worst-case credible Spill EMBA for MEE-01 (Table 2-1)

Receptor Areas - Potential Impact and Reference Scientific Monitoring Sites (marked X)

Receptors to be Monitored	Applicable SMP	Kimberley AMP	Agro-Rowley Terrace AMP	Montebello AMP	Dampier AMP	Carnarvon Canyon AMP	Ningaloo AMP	Gascoyne AMP	Shark Bay Open Ocean (including AMP)	Abrolhos AMP	Jurien AMP	Two Rocks AMP	Perth Canyon AMP	Geographe AMP	South-west Corner AMP	Ashmore Reef and AMP	Seringapatam Reef	Scott Reef (North and South)	Mermaid Reef and AMP	Clerke Reef and State Marine Park	Imperieuse Reef and State Marine Park	Rankin Bank
Habitat																						
Water Quality	SM01	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Marine Sediment Quality	SM02	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Coral Reef	SM03	X		X												X	X	X	X	X	X	X
Seagrass / Macro-Algae	SM03	X									X					X	X	X				
Deeper Water Filter Feeders	SM03	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mangroves and Saltmarsh	SM04																					
Species																						
Sea Birds and Migratory Shorebirds (significant colonies / staging sites / coastal wetlands)	SM05	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Marine Turtles (significant nesting beaches)	SM06	X	X	X	X		X	X	X							X	X	X	X	X	X	
Pinnipeds (significant colonies / haul-out sites)	SM07									X	X	X			X							
Cetaceans - Migratory Whales	SM08	X	X	X	X		X	X	X	X	X	X	X	X	X			X				
Oceanic and Coastal Cetaceans	SM08	X	X	X	X		X	X	X	X			X	X	X	X	X	X	X	X	X	X
Dugongs	SM08	X							X							X						
Sea Snakes	SM08	X		X	X			X	X	X						X	X	X	X	X	X	X
Whale Sharks	SM08			X			X	X										X				
Other Shark and Ray Populations	SM08, SM09	X	X	X	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X
Fish Assemblages	SM09	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Socio-economic																						
Fisheries - Commercial	SM10		X	X	X	X	X	X	X	X	X	X										X
Fisheries - Traditional	SM10															X	X	X				
Tourism (incl. recreational fishing)	SM10	X		X			X	X	X		X			X	X	X	X	X	X	X	X	X

Receptors to be Monitored	Glomar Shoals	Rowley Shoals (including Sate Maine Park)	Fantome Shoal	Adele Island	Lacepede Islands	Montebello Islands (including State Marine Park)	Lowendal Islands (including State Nature Reserves)	Barrow Island (including State Nature Reserves, State Marine Park and Marine Management Area)	Muiron Islands (WHA, Marine Management Area)	Pilbara Islands - Southern Island Group (Serrurier, Thevenard and Bessieres Islands - State Nature Reserves)	Pilbara Islands - Northern Island Group (Sandy Island Passage Islands - State nature reserves)	Abrolhos Islands	Kimberley Coast	Dampier Peninsula	Northern Pilbara Shoreline	Ningaloo Coast (North/North West Cape, Middle and South) (WHA, and State Marine Park)	Shark Bay - Open Ocean Coast	Shark Bay (WHA, State Marine Park)	Ngari Capes State Marine Park
Habitat																			
Water Quality	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Marine Sediment Quality	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Coral Reef	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	
Seagrass / Macro-Algae					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Deeper Water Filter Feeders	X	X	X						X							X			
Mangroves and Saltmarsh						X						X	X	X	X	X		X	
Species																			
Sea Birds and Migratory Shorebirds (significant colonies / staging sites / coastal wetlands)				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Marine Turtles (significant nesting beaches)					X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Pinnipeds (significant colonies / haul-out sites)																			X
Cetaceans - Migratory Whales					X	X	X	X	X			X	X	X		X		X	X
Oceanic and Coastal Cetaceans	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dugongs						X	X	X	X	X	X		X	X	X	X	X	X	
Sea Snakes	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Whale Sharks						X	X	X	X							X			
Other Shark and Ray Populations	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Assemblages	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Socio-economic																			
Fisheries - Commercial	X	X	X			X	X	X		X	X	X	X	X	X	X	X	X	X
Fisheries - Traditional					X													X	
Tourism (incl. recreational fishing)	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X

(dark red)	Receptor areas identified as Pre-emptive Baseline Areas (based on criteria of surface contact and/or entrained hydrocarbon contact ≤10 days (Offshore Australian Marine Parks contacted by hydrocarbons in this timeframe also noted)
(light red)	Receptor areas identified as Pre-Emptive Basline Areas in the response phase >10 days (based on criteria of surface contact and/or entrained hydrocarbon contact >10 days)
(white)	Receptor areas that may be identified as impact or reference sites in the event of major hydrocarbon release and would be identified as part of the SMP planning process

Table D-2: Baseline Studies for the SMPs applicable to identified Pre-emptive Baseline Areas for the Petroleum Activities Program

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank	Montebello AMP
Benthic Habitat (Coral Reef)	SM03 Quantitative assessment using image capture using either diver held camera or towed video. Post analysis into broad groups based on taxonomy and morphology.	Studies:	
		1. Glomar Shoals and Rankin Bank Environmental Survey Report, 2013, quantitatively surveyed benthic habitats and communities. AIMS report to Woodside. Scientific Publication - Biodiversity and spatial patterns of benthic habitat and associated demersal fish communities at two tropical submerged reef ecosystems, 2018. 2. Rankin Bank Environmental Survey Extension, 2014, Habitat assessment of an area southeast of Rankin Bank. 3. Glomar Shoals and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoals, 2018.	Coral Reefs & Filter Feeders 1. Montebello Marine Park, 2019, Identification and qualitative descriptions of benthic habitat. 2. Montebello Australian Marine Parks – 2019 – Baseline survey on benthic habitats. 3. Pluto Trunkline within Montebello Marine Park – Monitoring marine communities.
		Methods:	
		1. Towed video transects, photo quadrats using towed video system. 2. Towed video transects, photo quadrats using towed video system. 3. Towed video transects, photo quadrats using towed video system. 4. Towed video transects, photo quadrats using towed video system.	1.ROV Transects. 2. Benthic habitat mapping, multibeam acoustic swathing. 3. ROV video.
		References and Data:	
		1. AIMS 2014a and Abdul Wahab et al., 2018. DATAHOLDER: AIMS. 2. AIMS 2014b. DATAHOLDER: AIMS. 3.Currey-Randall et. al., 2019. DATAHOLDER: AIMS 4. Currey-Randall et. al., 2019. DATAHOLDER: AIMS	1. Advisian 2019 2. Keesing 2019 3. McLean et al. 2019
Benthic Habitat (Seagrass and Macro-algae)		Studies:	
		1. Glomar Shoals and Rankin Bank Environmental Survey Report, 2013, quantitatively surveyed benthic habitats and communities. AIMS report to Woodside. Scientific Publication - Biodiversity and spatial patterns of benthic habitat and associated demersal fish communities at two tropical submerged reef ecosystems, 2018. 2. Rankin Bank Environmental Survey Extension, 2014, Habitat assessment of an area southeast of Rankin Bank. 3. Glomar Shoals and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoals, 2018.	N/A – see table D – 1
		Methods:	

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank	Montebello AMP
	SM03 Quantitative assessment using image capture using either diver held camera or towed video. Post analysis into broad groups based on taxonomy and morphology.	1. Towed video transects, photo quadrats using towed video system. 2. Towed video transects, photo quadrats using towed video system. 3. Towed video transects, photo quadrats using towed video system. 4. Towed video transects, photo quadrats using towed video system	N/A – see table D – 1
		References and Data:	
		1. AIMS 2014a and Abdul Wahab et al., 2018. DATAHOLDER: AIMS. 2. AIMS 2014b. DATAHOLDER: AIMS. 3. Currey-Randall et. al., 2019. DATAHOLDER: AIMS 4. Currey-Randall et. al., 2019. DATAHOLDER: AIMS	N/A – see table D – 1
Benthic Habitat (Deeper Water Filter Feeders)	SM03 Quantitative assessment using image capture using towed video. Post analysis into broad groups based on taxonomy and morphology.	Studies:	
		1. Glomar Shoals and Rankin Bank Environmental Survey Report, 2013, quantitatively surveyed benthic habitats and communities. AIMS report to Woodside. Scientific Publication - Biodiversity and spatial patterns of benthic habitat and associated demersal fish communities at two tropical submerged reef ecosystems, 2018. 2. Rankin Bank Environmental Survey Extension, 2014, Habitat assessment of an area southeast of Rankin Bank. 3. Glomar Shoals and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoals, 2018.	N/A – see table D – 1
		Methods:	
		1. Towed video transects, photo quadrats using towed video system. 2. Towed video transects, photo quadrats using towed video system. 3. Towed video transects, photo quadrats using towed video system. 4. Towed video transects, photo quadrats using towed video system	N/A – see table D – 1
		References and Data:	

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank	Montebello AMP
		1. AIMS 2014a and Abdul Wahab et al., 2018. DATAHOLDER: AIMS. 2. AIMS 2014b. DATAHOLDER: AIMS. 3. Currey-Randall et. al., 2019. DATAHOLDER: AIMS 4. Currey-Randall et. al., 2019. DATAHOLDER: AIMS	N/A – see table D – 1
Mangroves and Saltmarsh	SM04 Aerial photography and satellite imagery will be used in conjunction with field surveys to map the range and distribution of mangrove communities.	Studies:	
		N/A – See Table D-1	N/A – see table D – 1
		Methods:	
		N/A – See Table D-1	N/A – see table D – 1
		References and Data:	
		N/A – See Table D-1	N/A – see table D – 1
Seabirds	SM05 Visual counts of breeding seabirds, nest counts, intertidal bird counts at high tide.	Studies:	
		N/A – See Table D-1	Present, in open water, no breeding habitat.
		Methods:	
		N/A – See Table D-1	N/A
		References and Data:	
		N/A – See Table D-1	N/A
Turtles	SM06 Beach surveys (recording species, nests, and false crawls).	Studies:	
		N/A – See Table D-1	Present, in open water, no nesting habitats.
		Methods:	
		N/A – See Table D-1	N/A
		References/Data:	
		N/A – See Table D-1	N/A
		Studies:	
		1. Glomar Shoals and Rankin Bank Environmental Survey Report, 2013, quantitatively surveyed benthic habitats and communities. AIMS report to Woodside. Scientific Publication - Biodiversity and spatial patterns of benthic habitat and associated demersal fish communities at two tropical submerged reef ecosystems, 2018. 2. Rankin Bank Environmental Survey Extension, 2014, Habitat assessment of an area southeast of Rankin Bank. 3. Glomar Shoals and Rankin Bank surveys, 2017. GWF-2 Monitoring Programme. Quantitatively surveyed benthic habitats and communities. 4. Temporal Studies survey of Rankin Bank and Glomar Shoals, 2018.	1. CSIRO – Fish Diversity. 2. Fish species richness and abundance.
		Methods:	

Major Baseline	Proposed Scientific monitoring operational plan and Methodology	Rankin Bank	Montebello AMP
Fish	Baited Remote Underwater Video Stations (BRUVS), Visual Underwater Counts (VUC), Diver Operated Video (DOV).	1. BRUVs. 2. BRUVs. 3. BRUVs. 4. BRUVs.	1. Semi V Wing trawl net or an epibenthic sled. 2. ROV Video.
		References/Data:	
		1. AIMS 2014a and Abdul Wahab et al., 2018. DATAHOLDER: AIMS. 2. AIMS 2014b. DATAHOLDER: AIMS. 3. Currey-Randall et. al., 2019. DATAHOLDER: AIMS 4. Currey-Randall et. al., 2019. DATAHOLDER: AIMS	1. Keesing 2019. 2. McLean et al. 2019.

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ANNEX E: TACTICAL RESPONSE PLANS

TACTICAL RESPONSE PLANS
Exmouth
Mangrove Bay
Turquoise Bay
Yardie Creek
Muiron Islands
Jurabi to Lighthouse Beaches Exmouth
Ningaloo Reef - Refer to Mangrove/Turquoise bay and Yardie Creek
Exmouth Gulf
Shark Bay Area 1: Carnarvon to Wooramel
Shark Bay Area 2: Wooramel to Petite Point
Shark Bay Area 3: Petite Point to Dubaut Point
Shark Bay Area 4: Dubaut Point to Herald Bight
Shark Bay Area 5: Herald Bight to Eagle Bluff
Shark Bay Area 6: Eagle Bluff to Useless Loop
Shark Bay Area 7: Useless Loop to Cape Bellefin
Shark Bay Area 8: Cape Bellefin to Steep Point
Shark Bay Area 9: Western Shores of Edel Land
Shark Bay Area 10: Dirk Hartog Island
Shark Bay Area 11: Bernier and Dorre Islands
Abrohlos Islands: Pelseart Group
Abrohlos Islands: Wallabi Group
Abrohlos Islands: Easter Group
Dampier
Rankin Bank & Glomar Shoals
Barrow and Lowendal Islands
Pilbara Islands - Southern Island Group
Montebello Island - Stephenson Channel Nth TRP
Montebello Island - Champagne Bay and Chippendale channel TRP
Montebello Island - Claret Bay TRP
Montebello Island - Hermite/Delta Island Channel TRP
Montebello Island - Hock Bay TRP
Montebello Island - North and Kelvin Channel TRP
Montebello Island - Sherry Lagoon Entrance TRP
Withnell Bay
Holden Bay
King Bay
No Name Bay / No Name Beach
Enderby Is -Dampier
Rosemary Island - Dampier
Legendre Is - Dampier
Karratha Gas Plant
KGP to Whitnell Creek

TACTICAL RESPONSE PLANS
KGP to Northern Shore
KGP Fire Pond & Estuary
KGP to No Name Creek
Broome
Sahul Shelf Submerged Banks and Shoals
Clerke Reef (Rowley Shoals)
Imperieuse Island (Rowley Shoals)
Mermaid Reef (Rowley Shoals)
Scott Reef
Oiled Wildlife Response
Exmouth
Dampier region
Shark Bay

APPENDIX E: NOPSEMA REPORTING FORMS

NOPSEMA Recordable Environmental Incident monthly Reporting Form
https://www.nopsema.gov.au/assets/Forms/A198750.doc
Report of an accident, dangerous occurrence or environmental incident
https://www.nopsema.gov.au/assets/Forms/N-03000-FM0831-Report-of-an-Accident-Dangerous-Occurrence-or-Environmental-Incident-Rev-8-Jan-2015-MS-Word-2010.docx

APPENDIX F: STAKEHOLDER CONSULTATION

WA-49-L Anchor Hold Testing Environment Plan

December 2019
Revision: 0

TABLE OF CONTENTS

1. Consultation

1.1 Email sent to relevant stakeholders (18 – 21 November 2019)

Woodside sent the email below and consultation Information Sheet below to:

- *Australian Customs Service (ACS)*
- *Department of Industry, Innovation and Science (DIIS)*
- *Department of Mines, Industry Regulation and Safety (DMIRS)*
- *Australian Petroleum Production and Exploration Association (APPEA)*

Dear stakeholder

Woodside is planning to undertake anchor holding testing within permit area WA-49-L starting in Q1 2020, subject to approvals, vessel availability and weather constraints.

The anchor holding testing activities are expected to take 14 days, with test results informing planning activities for the proposed exploration Gemtree-A exploration well, which is planned to be drilled in WA-49-L from Q3 2020.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website.

Activity overview

Activity purpose:	• To support planning for the Gemtree-A Exploration well, which is planned to be drilled from Q3 2020
Activity:	• Lowering an anchor to the seafloor and then tensioning to determine the anchor's ability to hold, embed and not drag at the Gemtree-A location.
Activity location:	• Approximately 178 km north west of Dampier, Western Australia.
Approximate water depth:	• 200 m
Earliest commencement date:	• Q1 2020
Estimated duration:	• 14 days
Vessels:	• Anchor handling and support vessels
Exclusion zones:	• An Operational Area with a 4000 m radius from the Gemtree-A well centre for the duration of activities

Your feedback
Your feedback on the proposed activity and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by **18 December 2019** to allow us sufficient time to inform our planning for the proposed activity. Comments can be made by email, letter or by phone.

Regards

[redacted]
Corporate Affairs Manager | Exploration
Woodside Energy Ltd

1.2 Woodside Consultation Information Sheet

Woodside

STAKEHOLDER CONSULTATION INFORMATION SHEET

November 2019

WA-49-L ANCHOR HOLD TESTING ENVIRONMENT PLAN

BARROW SUB-BASIN, NORTH-WEST AUSTRALIA

Woodside is planning to undertake anchor hold testing within permit area WA-49-L, starting in Q1 2020, subject to approvals, vessel availability and weather constraints.

The anchor hold testing activities are expected to take fourteen (14) days, with test results informing planning activities for the proposed exploration Gemtree-A exploration well. Drilling of the Gemtree-A exploration well is planned to commence from Q3 2020.

Permit WA-49-L is held by Woodside (Operator and 65% interest) and KUFPEC Australia Pty Ltd (35% interest).

Proposed Activity

The proposed activity will involve an anchor handling vessel lowering an anchor to the seafloor in the Operational Area for the Gemtree-A exploration well and then tensioning the anchor to determine its ability to hold, embed and resist drag at the location. The anchor will be recovered once testing is complete.

This process may need to be repeated several times within the Operational Area. A remotely operated vehicle may also be used to judge how deep the anchor has embedded and independently verify the seabed condition.

Soil analysis may also be necessary to (a) provide data on composition and rock/substrate strength as inputs to the mooring design; and (b) verify seabed conditions for anchor holding. Soil analysis could include taking a physical sample of the seabed using a remotely operated vehicle or other tools, or using measuring devices, such as a cone penetrometer.

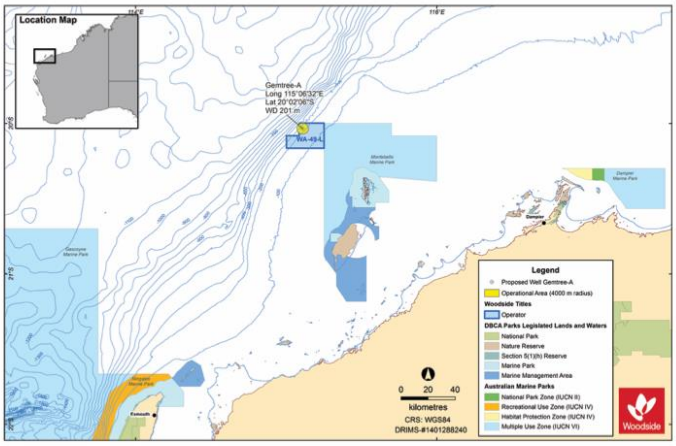


Table 1. Activity summary

Gemtree Exploration Well Anchor Testing	
Commencement date	+ Q1 2020
Gemtree-A well location	+ 20° 02' 06.754 S + 115° 06' 32.749 E
Approximate estimated duration	+ 14 days
Water depth	+ ~ 200 m
Project vessels	+ Anchor handling vessel + Support vessels
Distance to nearest port	+ ~178 km north west of Dampier
Distance to nearest marine park	+ 47 km west of Montebello Marine Park

Activity Vessels

An anchor handling vessel will undertake the proposed activity. Support vessels may also be required to transport equipment and materials between the anchor handling vessel and port.

Communications with Mariners

For the purposes of the Environment Plan and for the duration of the proposed activity:

- An Operational Area with a 4000 m radius from the Gemtree-A well centre will be established.
- Marine notices will be issued prior to activity commencement to alert vessels which maybe operating in waters nearby.

Implications for stakeholders

Woodside will consult relevant stakeholders whose interests, functions and activities may be affected by the proposed activities. We will also keep other stakeholders who have identified an interest in the activities informed about our planned activities.

Woodside has undertaken an assessment to identify potential risks to the marine environment and relevant stakeholders considering timing, duration, location and potential impacts arising from the anchor hold testing activities.

A number of mitigation and management measures will be implemented and are summarised in the Table 2. Further details will be provided in the Environment Plan.

Table 2. Summary of key risks and/or impacts and management measures

Potential Risk and/or Impact	Mitigation and/or Management Measure
Chemical use	+ Chemical use will be managed in accordance with Woodside and contractor chemical selection and approval procedures.
Interests of relevant stakeholders including: + Commercial fishing activities + Defence activities + Petroleum activities + Shipping activities	+ Consultation with relevant petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies to inform decision making for the proposed activity and development of the Environment Plan. + Advice to relevant stakeholders prior to the commencement of activities.
Marine fauna interactions	+ Measures will be taken to protect marine fauna and ecosystems from vessel activities and to prevent vessel collisions and groundings.
Marine discharges	+ The deployment, testing and retrieval of the anchor for anchor hold testing is likely to result in a localised, physical modification to the seabed and disturbance to soft sediment.
Seabed disturbance	+ The deployment, testing and retrieval of the anchor for anchor hold testing is likely to result in a localised, physical modification to the seabed and disturbance to soft sediment.
Vessel interaction	+ Woodside will notify relevant fishery stakeholders and Government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity. + An Operational Area with a radius of 4000 m from the proposed Gemtree-A exploration well location will be established. + Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area.
Waste generation	+ Waste generated on the vessels will be managed in accordance with legislative requirements and a Waste Management Plan.
Unplanned	
Hydrocarbon release	+ Appropriate spill response plans, equipment and materials will be in place and maintained. + Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment.
Introduction of invasive marine species	+ All vessels will be assessed and managed as appropriate to prevent the introduction of invasive marine species. + Compliance with Australian biosecurity requirements and guidance.

Providing feedback

Our intent is to minimise environmental and social impacts associated with the proposed activities, and we are seeking any interest or comments you may have to inform our decision making.

If you would like to comment on the proposed activities outlined in this information sheet, or would like additional information, please contact Woodside before **18 December 2019**.

Please note that your feedback and our response will be included in our Environment Plan for the proposed activity, which will be submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

A copy of this consultation Information Sheet will remain available on our website for the duration of public consultation and the Petroleum Activities Program.

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Andrew Decet, Corporate Affairs Manager | Exploration
E: Feedback@woodside.com.au | Toll free: 1800 442 977

Please note that stakeholder feedback will be communicated to NOPSEMA as required under legislation. Woodside will communicate any material changes to the proposed activity to affected stakeholders as they arise.

Woodside

www.woodside.com.au

1.3 Email sent to DPIRD, WAFIC, PPA, Pilbara Trap and Line Fishery licence holders and charter boat operators (19 November 2019)

Dear [redacted]

Woodside is planning to undertake anchor holding testing within permit area WA-49-L starting in Q1 2020, subject to approvals, vessel availability and weather constraints.

The anchor holding testing activities are expected to take 14 days, with test results informing planning activities for the proposed exploration Gemtree-A exploration well, which is planned to be drilled in WA-49-L from Q3 2020.

We have identified and assessed potential risks and impacts to active commercial fishers and the marine environment that overlap the proposed Operational Area in the development of the proposed Environment Plan for this activity. These risks are summarised below.

Woodside has endeavoured to reduce these risks to an as low as reasonably practicable (ALARP) level. Please contact me if you believe we have overlooked any potential impacts to the commercial fishing industry or missed any points of importance so these can be addressed.

A Consultation Information Sheet (also available on our website) and a map of State Fisheries relevant to the proposed activities is attached.

Fisheries have been identified as being relevant on the basis of fishing licence overlap with the proposed activity area, as well as consideration of government fishing effort data from recent years, fishing methods and water depth. Individual licence holders or representative fishing organisations who have requested ongoing advice on Woodside's planned activities will also be advised.

Activity overview

Activity purpose:	• To support planning for the Gemtree-A Exploration well, which is planned to be drilled from Q3 2020
Activity:	• Lowering an anchor to the seafloor and then tensioning to determine the anchor's ability to hold, embed and not drag at the Gemtree-A location.
Activity location:	• Approximately 178 km north west of Dampier, Western Australia.
Approximate water depth:	• 200 m
Earliest commencement date:	• Q1 2020
Estimated duration:	• 14 days
Vessels:	• Anchor handling and support vessels
Relevant fisheries consulted for this activity:	• State Fisheries ○ Pilbara Line Fishery ○ Pilbara Trap Fishery
Exclusion zones:	• An Operational Area with a 4000 m radius from the Gemtree-A well centre for the duration of activities

Potential risks to commercial fishing and proposed mitigation measures

Potential risk	Risk description	Mitigation and/or management measures
Planned Activities		
Physical presence	• The presence of the project vessels may result in exclusion of other users, or interactions between vessels.	• Woodside will implement an Operational Area with a 4000 m radius from the Gemtree-A well centre for the duration of activities. Notification and updates to mariners and marine charts. • Woodside will routinely consult with marine users to ensure they are informed and aware thereby reducing the likelihood of interactions.
Seabed disturbance	• Disturbance to the seabed from anchor holding testing.	• Preliminary mooring analysis
Underwater noise	• Noise will be generated by the project vessels.	• Due to the low acoustic source levels associated with the project vessels, there is not likely to be any interaction or potential impact to fish hearing, feeding or spawning.
Marine discharges	• Operational discharges from the project vessels, including, sewage, putrescible water, grey water, bilge water, drain water cooling water and brine. • These discharges may result in a localised short-term reduction in water quality however they will be rapidly diluted and dispersed in the water column.	• Discharges are compliant with industry best practice standards. • Implementation of chemical assessment and approval process.
Unplanned Risks		
Hydrocarbon release	• Loss of hydrocarbons to the marine environment from a vessel collision resulting in a tank rupture.	• Relevant agencies and organisations will be notified as appropriate to the nature and scale of the event, as soon as practicable following the occurrence. • Oil spill response strategies will be implemented based on

Potential risk	Risk description	Mitigation and/or management measures
		potential impact to identified key receptor locations and sensitivities, which includes fish spawning and nursery areas.
Invasive Marine Species	• Introduction or translocation and establishment of invasive marine species to the area via vessels ballast water or biofouling.	• All vessels will be assessed and managed as appropriate to prevent the introduction of invasive marine species. • Compliance with Australian biosecurity requirements and guidance.

Your feedback
Your feedback on the proposed activity and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).
Notification will be provided to relevant marine users closer to the time of the proposed activity.

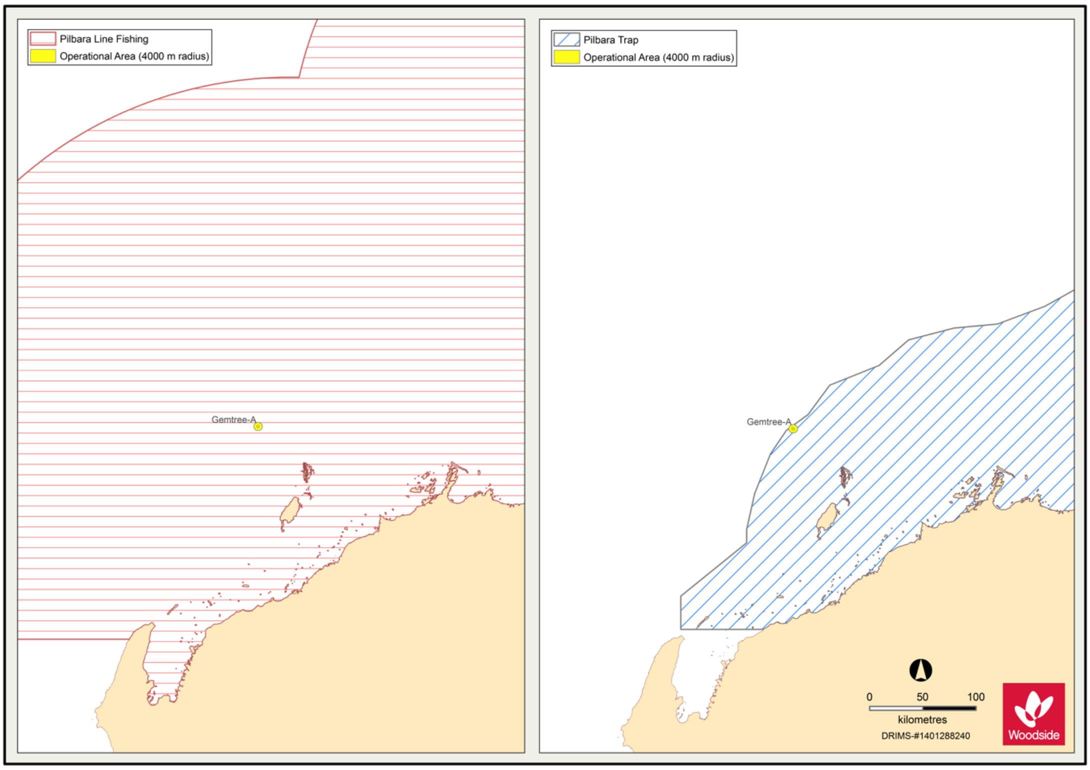
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by **18 December 2019** to allow us sufficient time to inform our planning for the proposed activity. Comments can be made by email, letter or by phone.

Regards

[redacted]
Corporate Affairs Manager | Exploration
Woodside Energy Ltd

1.4 State Fisheries map sent to DPIRD, WAFIC, PPA and Pilbara Line and Trap Fishery licence holders (19 December 2019)



1.5 Email sent to AFMA, CFA and North West Slope Trawl Fishery licence holders (19 November 2019)

Dear [redacted]

Woodside is planning to undertake anchor holding testing within permit area WA-49-L starting in Q1 2020, subject to approvals, vessel availability and weather constraints.

The anchor holding testing activities are expected to take 14 days, with test results informing planning activities for the proposed exploration Gemtree-A exploration well, which is planned to be drilled in WA-49-L from Q3 2020.

We have identified and assessed potential risks and impacts to active commercial fishers and the marine environment that overlap the proposed Operational Area in the development of the proposed Environment Plan for this activity. These risks are summarised below.

Woodside has endeavoured to reduce these risks to an as low as reasonably practicable (ALARP) level. Please contact me if you believe we have overlooked any potential impacts to the commercial fishing industry or missed any points of importance so these can be addressed.

A Consultation Information Sheet (also available on our website) and a map of State Fisheries relevant to the proposed activities is attached.

Fisheries have been identified as being relevant on the basis of fishing licence overlap with the proposed activity area, as well as consideration of government fishing effort data from recent years, fishing methods and water depth. Individual licence holders or representative fishing organisations who have requested ongoing advice on Woodside's planned activities will also be advised.

Activity overview

Activity purpose:	• To support planning for the Gemtree-A Exploration well, which is planned to be drilled from Q3 2020
Activity:	• Lowering an anchor to the seafloor and then tensioning to determine the anchor's ability to hold, embed and not drag at the Gemtree-A location.
Activity location:	• Approximately 178 km north west of Dampier, Western Australia.
Approximate water depth:	• 200 m
Earliest commencement date:	• Q1 2020
Estimated duration:	• 14 days
Vessels:	• Anchor handling and support vessels
Relevant fisheries consulted for this activity:	• State Fisheries ○ Pilbara Line Fishery ○ Pilbara Trap Fishery
Exclusion zones:	• An Operational Area with a 4000 m radius from the Gemtree-A well centre for the duration of activities

Potential risks to commercial fishing and proposed mitigation measures

Potential risk	Risk description	Mitigation and/or management measures
Planned Activities		
Physical presence	• The presence of the project vessels may result in exclusion of other users, or interactions between vessels.	• Woodside will implement an Operational Area with a 4000 m radius from the Gemtree-A well centre for the duration of activities. Notification and updates to mariners and marine charts. • Woodside will routinely consult with marine users to ensure they are informed and aware thereby reducing the likelihood of interactions.
Seabed disturbance	• Disturbance to the seabed from anchor holding testing.	• Preliminary mooring analysis

Potential risk	Risk description	Mitigation and/or management measures
Underwater noise	• Noise will be generated by the project vessels.	• Due to the low acoustic source levels associated with the project vessels, there is not likely to be any interaction or potential impact to fish hearing, feeding or spawning.
Marine discharges	• Operational discharges from the project vessels, including, sewage, putrescible water, grey water, bilge water, drain water cooling water and brine. • These discharges may result in a localised short-term reduction in water quality however they will be rapidly diluted and dispersed in the water column.	• Discharges are compliant with industry best practice standards. • Implementation of chemical assessment and approval process.
Unplanned Risks		
Hydrocarbon release	• Loss of hydrocarbons to the marine environment from a vessel collision resulting in a tank rupture.	• Relevant agencies and organisations will be notified as appropriate to the nature and scale of the event, as soon as practicable following the occurrence. • Oil spill response strategies will be implemented based on potential impact to identified key receptor locations and sensitivities, which includes fish spawning and nursery areas.
Invasive Marine Species	• Introduction or translocation and establishment of invasive marine species to the area via vessels ballast water or biofouling.	• All vessels will be assessed and managed as appropriate to prevent the introduction of invasive marine species. • Compliance with Australian biosecurity requirements and guidance.

Your feedback

Your feedback on the proposed activity and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Notification will be provided to relevant marine users closer to the time of the proposed activity.

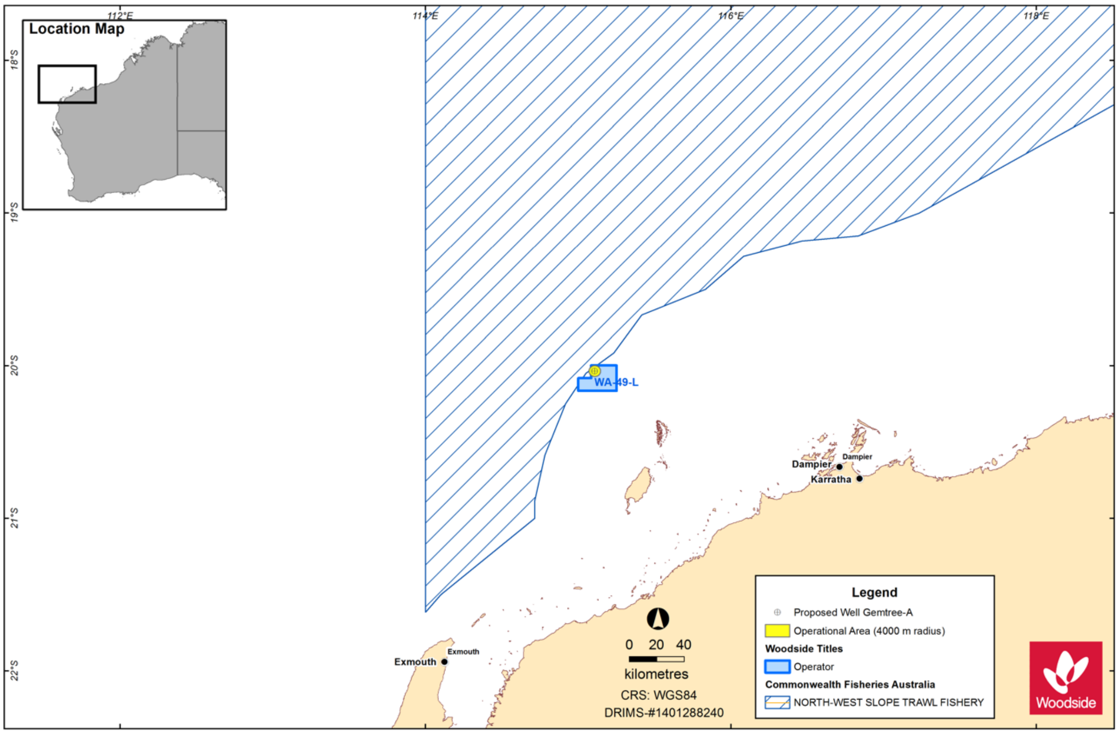
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by **18 December 2019** to allow us sufficient time to inform our planning for the proposed activity. Comments can be made by email, letter or by phone.

Regards

[redacted]
Corporate Affairs Manager | Exploration
Woodside Energy Ltd

1.6 Commonwealth Fisheries map sent to AFMA, CFA and North West Slope Trawl Fishery licence holders (19 November 2019)



1.7 Email sent to DoD – 18 November 2019

Dear [redacted]

Woodside is planning to undertake anchor holding testing within permit area WA-49-L starting in Q1 2020, subject to approvals, vessel availability and weather constraints.

The anchor holding testing activities are expected to take 14 days, with test results informing planning activities for the proposed exploration Gemtree-A exploration well, which is planned to be drilled in WA-49-L from Q3 2020.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website.

A map of Defence areas relevant to the proposed activity is also attached.

Activity overview

Activity purpose:	• To support planning for the Gemtree-A Exploration well, which is planned to be drilled from Q3 2020
Activity:	• Lowering an anchor to the seafloor and then tensioning to determine the anchor's ability to hold, embed and not drag at the Gemtree-A location.
Activity location:	• Approximately 178 km north west of Dampier, Western Australia.
Approximate water depth:	• 200 m
Earliest commencement date:	• Q1 2020
Estimated duration:	• 14 days
Vessels:	• Anchor handling and support vessels
Exclusion zones:	• An Operational Area with a 4000 m radius from the Gemtree-A well centre for the duration of activities

Your feedback
Your feedback on the proposed activity and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

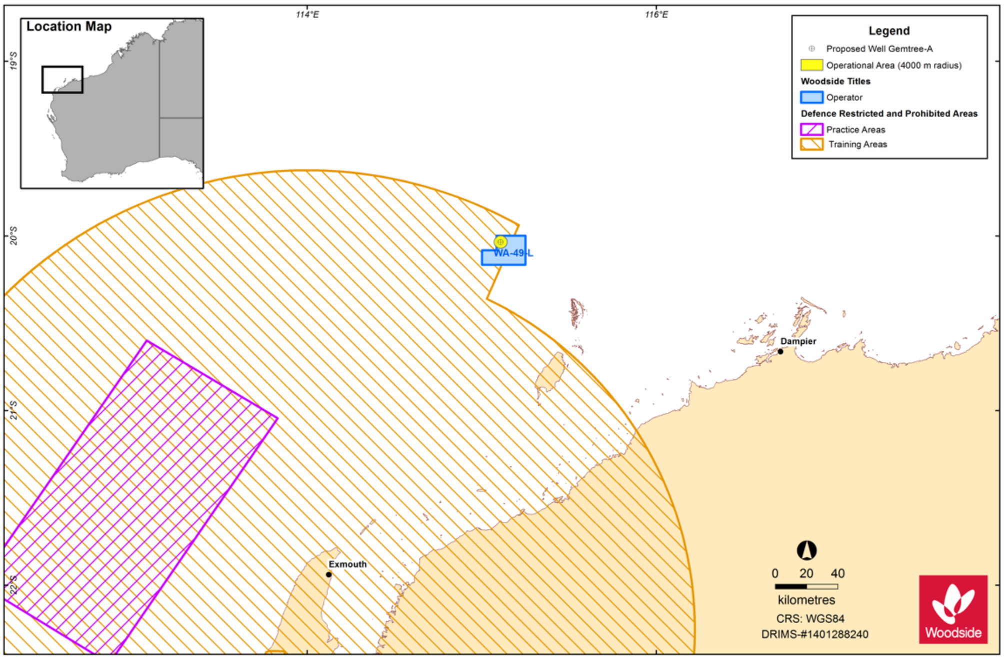
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by **18 December 2019** to allow us sufficient time to inform our planning for the proposed activity. Comments can be made by email, letter or by phone.

Regards

[redacted]
Corporate Affairs Manager | Exploration
Woodside Energy Ltd

1.8 Defence map sent to DoD – 18 November 2019



1.9 Email sent to adjacent titleholder – Chevron – 18 November 2019

Dear [redacted]

Woodside is planning to undertake anchor holding testing within permit area WA-49-L starting in Q1 2020, subject to approvals, vessel availability and weather constraints.

The anchor holding testing activities are expected to take 14 days, with test results informing planning activities for the proposed exploration Gemtree-A exploration well, which is planned to be drilled in WA-49-L from Q3 2020.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website.

A map of adjacent titles relevant to the proposed activity is also attached.

Activity overview

Activity purpose:	• To support planning for the Gemtree-A Exploration well, which is planned to be drilled from Q3 2020
Activity:	• Lowering an anchor to the seafloor and then tensioning to determine the anchor's ability to hold, embed and not drag at the Gemtree-A location.
Activity location:	• Approximately 178 km north west of Dampier, Western Australia.
Approximate water depth:	• 200 m
Earliest commencement date:	• Q1 2020

Estimated duration:	• 14 days
Vessels:	• Anchor handling and support vessels
Exclusion zones:	• An Operational Area with a 4000 m radius from the Gemtree-A well centre for the duration of activities

Your feedback
Your feedback on the proposed activity and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the Offshore Petroleum and Greenhouse *Gas Storage (Environment) Regulations 2009* (Cth).

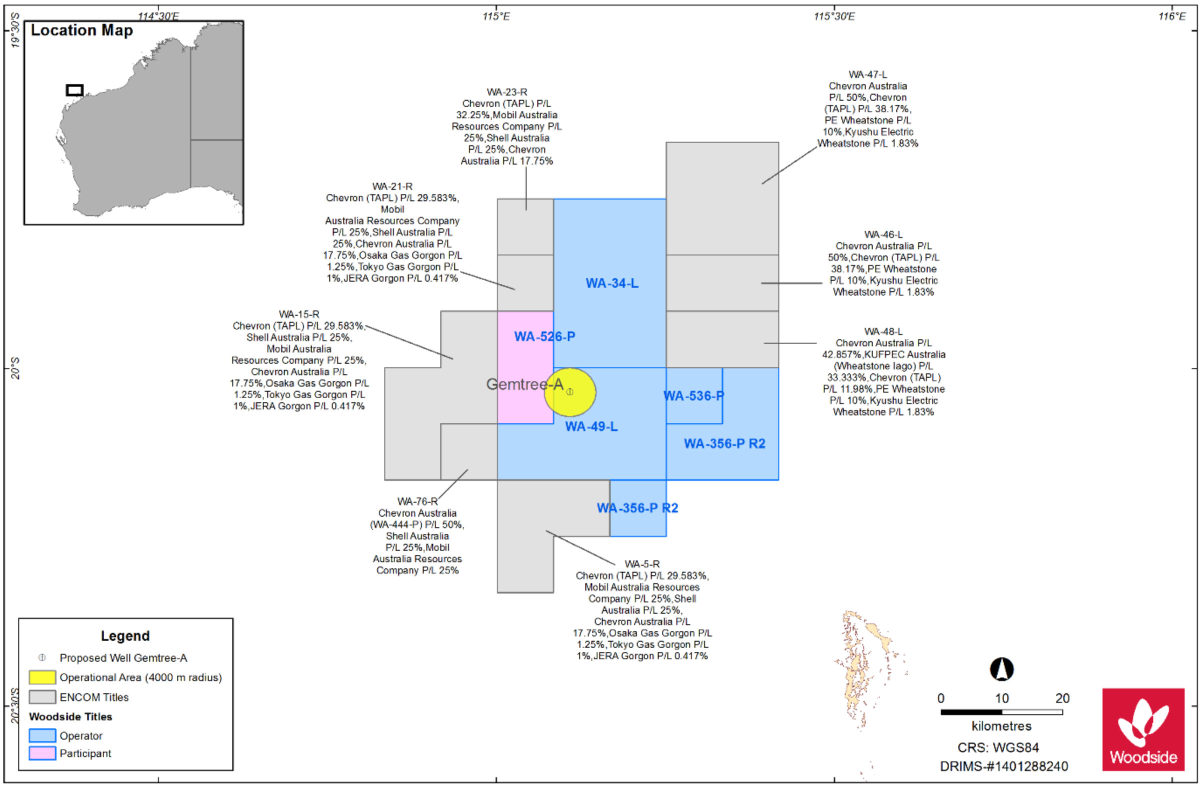
Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by **18 December 2019** to allow us sufficient time to inform our planning for the proposed activity. Comments can be made by email, letter or by phone.

Regards

[redacted]
Corporate Affairs Manager | Exploration
Woodside Energy Ltd

1.10 Titles map sent to adjacent titleholder – Chevron – 18 November 2019



1.11 Email sent to DAWR – 18 November 2019

Dear Department of Agriculture and Water Resources

Woodside is planning to undertake anchor holding testing within permit area WA-49-L starting in Q1 2020, subject to approvals, vessel availability and weather constraints.

The anchor holding testing activities are expected to take 14 days, with test results informing planning activities for the proposed exploration Gemtree-A exploration well, which is planned to be drilled in WA-49-L from Q3 2020.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website.

Activity overview

Activity purpose:	• To support planning for the Gemtree-A Exploration well, which is planned to be drilled from Q3 2020
Activity:	• Lowering an anchor to the seafloor and then tensioning to determine the anchor's ability to hold, embed and not drag at the Gemtree-A location.
Activity location:	• Approximately 178 km north west of Dampier, Western Australia.
Approximate water depth:	• 200 m
Earliest commencement date:	• Q1 2020
Estimated duration:	• 14 days
Vessels:	• Anchor handling and support vessels
Exclusion zones:	• An Operational Area with a 4000 m radius from the Gemtree-A well centre for the duration of activities

Commercial fishing
Three Commonwealth Fisheries overlap the proposed Operational Area (see attached map) and it is our assessment that there is potential interaction with the North West Slope Trawl Fishery. Woodside has sent consultation material to licence holders in this fishery.

Biosecurity
With respect to the biosecurity matters, please note the following information below.

Vessels:	• All vessels are required to undergo a Woodside Marine Assurance Inspection to review compliance with marine laws and Woodside safety and environmental requirements. • Vessels may be sourced from the local area (Dampier, Karratha, etc) or from further afield, depending on the type of vessel required and availability
Environment description:	• The exploration well is located on the continental shelf and the seabed around the exploration well is relatively flat and featureless. Seabed relief in areas of bare

	sediment consisted mainly of 'small ripples' less than 0.1 m high, which is consistent with tidally driven bottom currents. • The activity is approximately 43 km west of the Montebello Marine Park.
IMS risk:	• Introduction or translocation and establishment of invasive marine species to the area via vessels or biofouling. • Introducing invasive marine species into the local marine environment will alter the ecosystem, as invasive species have characteristics that make them superior (in a survival and/or reproductive sense) to the indigenous species. • Invasive marine species have also proven economically damaging to areas where they have been introduced and established.
Ballast and biofouling management:	• Compliance with National Ballast Water and Biofouling Management Requirements (as defined under the *Biosecurity Act 2015*). • Requirements are aligned with the International Convention for the Control and Management of Ships' Ballast Water and Sediments and the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry. • As a minimum, all vessels mobilised from outside of Australia will under-take ballast water exchange > 12 nm from land and > 50 m water depth. • The operator of a vessel must provide a ballast water report if it is intended that the vessel discharge, or the vessel discharges, ballast water in Australian seas.
IMS mitigation:	• Vessels will be assessed and managed to prevent the introduction of invasive marine species in accordance with Woodside's Invasive Marine Species Management Plan. • Woodside's Invasive Marine Species Management Plan includes a risk assessment process that is applied to vessels undertaking Activities. Based on the outcomes of each IMS risk assessment, Management measures commensurate with the risk (such as the treatment of internal systems, IMS inspections or cleaning) will be implemented to minimise the likelihood of IMS being introduced. • Vessels are required to comply with the *Australian Biosecurity Act 2015.*

Your feedback

Your feedback on the proposed activity and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

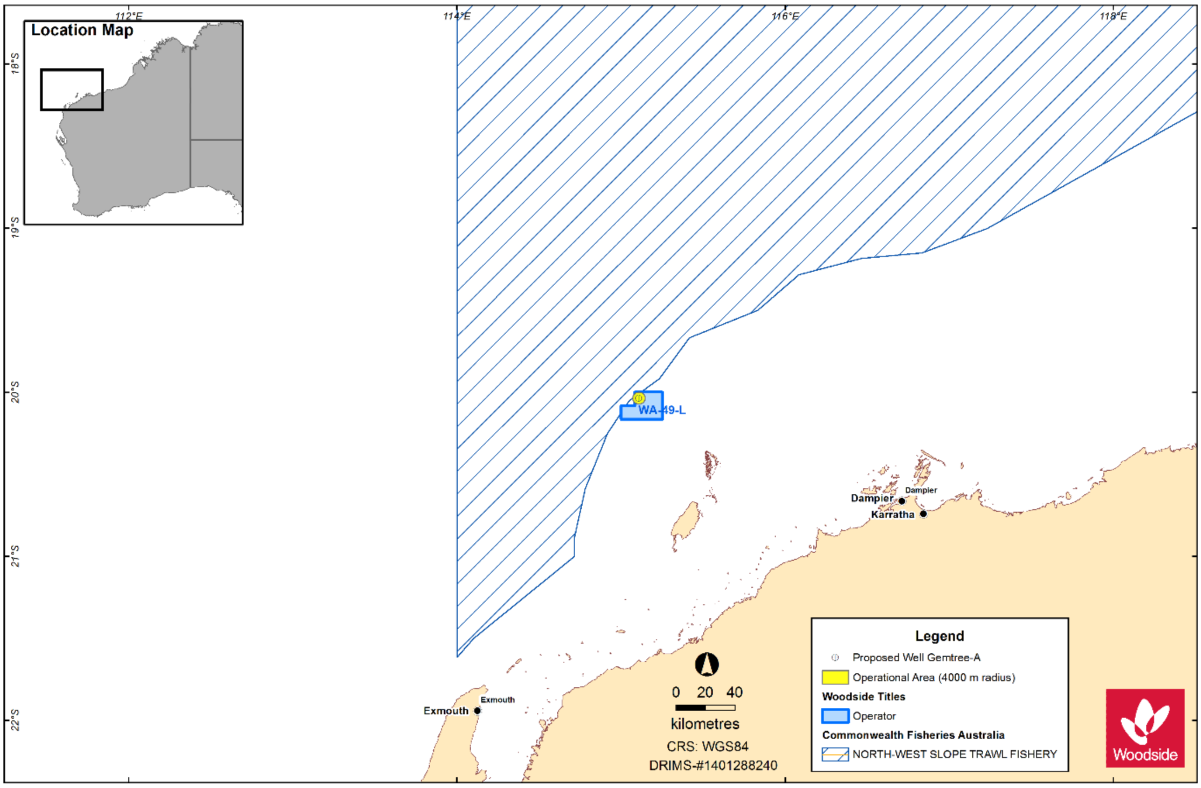
Please provide your views by **18 December 2019** to allow us sufficient time to inform our planning for the proposed activity. Comments can be made by email, letter or by phone.

Regards

[redacted]

Corporate Affairs Manager | Exploration
Woodside Energy Ltd

1.12 Commonwealth Fisheries map sent to DAWR – 18 November 2019



1.13 Email sent to AMSA (marine safety) and AHO – 18 November 2019

Dear [redacted]

Woodside is planning to undertake anchor holding testing within permit area WA-49-L starting in Q1 2020, subject to approvals, vessel availability and weather constraints.

The anchor holding testing activities are expected to take 14 days, with test results informing planning activities for the proposed exploration Gemtree-A exploration well, which is planned to be drilled in WA-49-L from Q3 2020.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website.

A map of shipping lanes relevant to the proposed activity is also attached.

Activity overview

Activity purpose:	• To support planning for the Gemtree-A Exploration well, which is planned to be drilled from Q3 2020
Activity:	• Lowering an anchor to the seafloor and then tensioning to determine the anchor's ability to hold, embed and not drag at the Gemtree-A location.
Activity location:	• Approximately 178 km north west of Dampier, Western Australia.
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Your feedback

Your feedback on the proposed activity and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

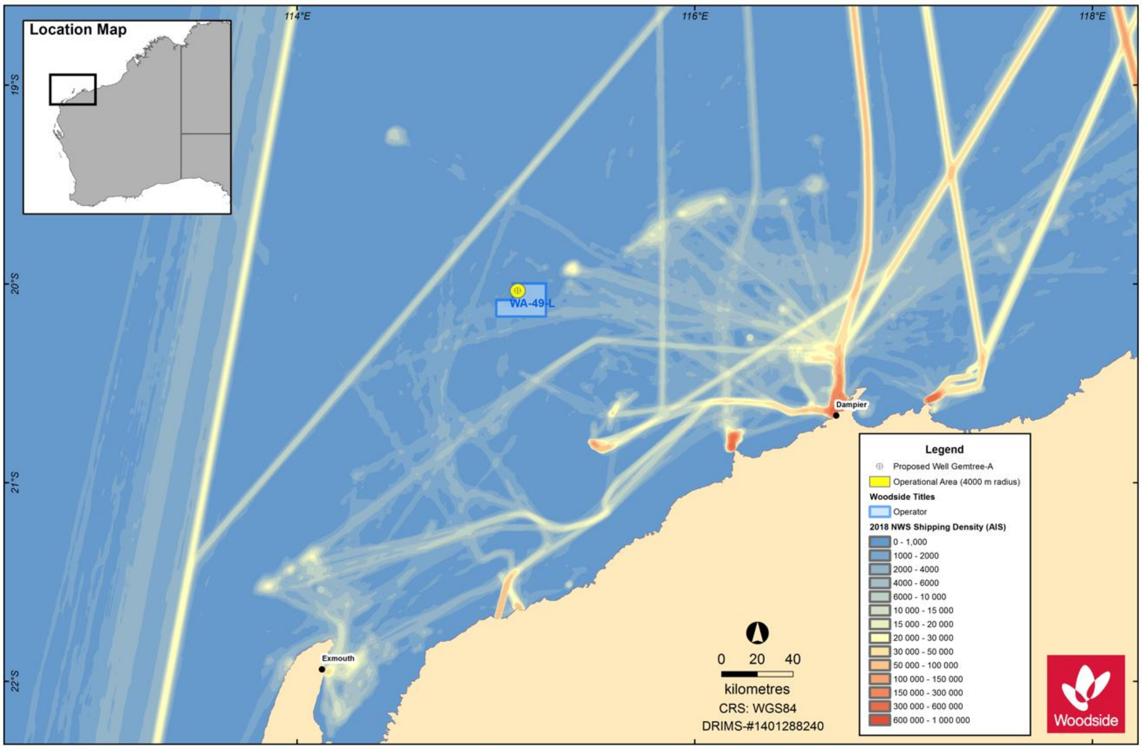
Please provide your views by **18 December 2019** to allow us sufficient time to inform our planning for the proposed activity. Comments can be made by email, letter or by phone.

Regards

[redacted]

Corporate Affairs Manager | Exploration
Woodside Energy Ltd

1.14 Shipping fairways map sent to AMSA (marine safety) and AHO – 18 November 2019



1.15 Email sent to AMSA (marine pollution) and DoT – 18 November 2019

Dear [redacted]

Woodside is planning to undertake anchor holding testing within permit area WA-49-L starting in Q1 2020, subject to approvals, vessel availability and weather constraints.

The anchor holding testing activities are expected to take 14 days, with test results informing planning activities for the proposed exploration Gemtree-A exploration well, which is planned to be drilled in WA-49-L from Q3 2020.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our <u>website</u>.

We will provide a copy of our Oil Pollution First Strike Plan once planning is finalised.

Activity overview

Activity purpose:	• To support planning for the Gemtree-A Exploration well, which is planned to be drilled from Q3 2020
Activity:	• Lowering an anchor to the seafloor and then tensioning to determine the anchor's ability to hold, embed and not drag at the Gemtree-A location.
Activity location:	• Approximately 178 km north west of Dampier, Western Australia.

Approximate water depth:	• 200 m
Earliest commencement date:	• Q1 2020
Estimated duration:	• 14 days
Vessels:	• Anchor handling and support vessels
Exclusion zones:	• An Operational Area with a 4000 m radius from the Gemtree-A well centre for the duration of activities

Your feedback
Your feedback on the proposed activity and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by **18 December 2019** to allow us sufficient time to inform our planning for the proposed activity. Comments can be made by email, letter or by phone.

Regards

[redacted]
Corporate Affairs Manager | Exploration
Woodside Energy Ltd

1.16 Email sent to AMSA with first strike plan – 22 November 2019

Good Morning [redacted]

As part of Woodside's ongoing consultation for its current and planned activities, I would like to advise the Australian Maritime Safety Authority (AMSA) that Woodside are preparing the *Gemtree Anchor Hold Test Environment Plan* and would like to offer AMSA the opportunity to review or provide comment on the activity.

Information is presented as follows:

- A Consultation Information Sheet is available on our website here, providing information on the proposed petroleum activities program.

- The *Gemtree Anchor Hold Test Oil Pollution First Strike Plan* is attached. This will form part of the approval submission in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth). Please note at this stage of drafting some of the links and figures in the document are still being finalised, and as such may show as incomplete.

Woodside propose to submit an EP 20 December 2019 to support these activities.

Should you require additional information or have a comment to make about the proposed activity, please contact myself by close of business 6th December to allow us sufficient time to inform our activity planning and EP development.

Comments can be made by email, letter or by phone.

Please be aware that your feedback will be communicated to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), as is required under legislation.

We look forward to hearing from you.

Kind Regards

[redacted]

[redacted]
Hydrocarbon Spill Adviser | Security & Emergency Management
Woodside Energy Ltd

1.17 Email sent to DNP – 19 November 2019

Dear Director of National Parks

Woodside is planning to undertake anchor holding testing within permit area WA-49-L starting in Q1 2020, subject to approvals, vessel availability and weather constraints.

The anchor holding testing activities are expected to take 14 days and were originally planned as part of activities for the Gemtree-A exploration well, which is planned to be drilled in WA-49-L from Q3 2020. However, the activity has been brought forward to inform planning for the Gemtree well and, as a result, will require a separate Environment Plan.

We note Australian Government Guidance on consultation activities with respect to the proposed activities and confirm that:

- The proposed activities are outside the boundaries of proclaimed Australian Marine Parks the nearest being Montebello Marine Park, 47 km to the south east of the Operational Area.
- We have assessed potential risks to Australian Marine Parks in the development of the proposed Environment Plan for this activity and believe that there are no credible risks as part of planned activities that have potential to impact the values of the Marine Parks.
- The worst-case credible spill scenario assessed in the Environment Plan for this activity is the highly unlikely event of a vessel collision, resulting in a loss of diesel fuel. Given the controls in place, it is considered that the risk associated with such an event is managed to as low as reasonably practicable (ALARP).

In the unlikely event of a loss of fuel, there is a risk of diesel entering the following Marine Parks:

- Montebello Marine Park
- Gascoyne Marine Park

A Commonwealth Government approved oil spill response plan will be in place for the duration of the activities, which includes notification to relevant agencies and organisations as to the nature and scale of the event, as soon as practicable following an occurrence. The Director of National Parks will be advised if an environmental incident occurs that may impact on the values of a marine park.

For information, a Consultation Information Sheet about the planned activity is attached, which provides background on the activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website.

Can you please provide feedback on the proposed activity by **18 December 2019**, noting that your feedback and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth). Comments can be made by email, letter or by phone.

[redacted]
Corporate Affairs Manager | Exploration
Woodside Energy Ltd

APPENDIX G: DEPARTMENT OF ABORIGINAL AFFAIRS HERITAGE INQUIRY SYSTEM RESULTS

Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

Search Criteria

No Registered Aboriginal Sites in Custom search area - Polygon - 115.538810224915°E, 20.0509661454°S (GDA94) : 115.126822920228°E, 20.2366235985055°S (GDA94) : 115.033439131165°E, 20.4117633802247°S (GDA94) : 114.71483561554°E, 20.930852541942°S (GDA94) : 114.31932780304°E, 21.3509745000002°S (GDA94) : 113.687613935853°E, 21.6474100210881°S (GDA94) : 113.379996748353°E, 21.4839340805736°S (GDA94) : 114.550040693665°E, 20.4580906586632°S (GDA94) : 115.00048014679°E, 19.8702550757595°S (GDA94) : 115.37401530304°E, 19.7255376634368°S (GDA94) : 115.538810224915°E, 20.0509661454°S (GDA94)

Disclaimer

The *Aboriginal Heritage Act 1972* preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at heritageenquiries@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

Copyright

Coordinate Accuracy

Coordinates (Easting/Northing metres) are based on the GDA 94 Datum. Accuracy is shown as a code in brackets following the coordinates.

Basemap Copyright

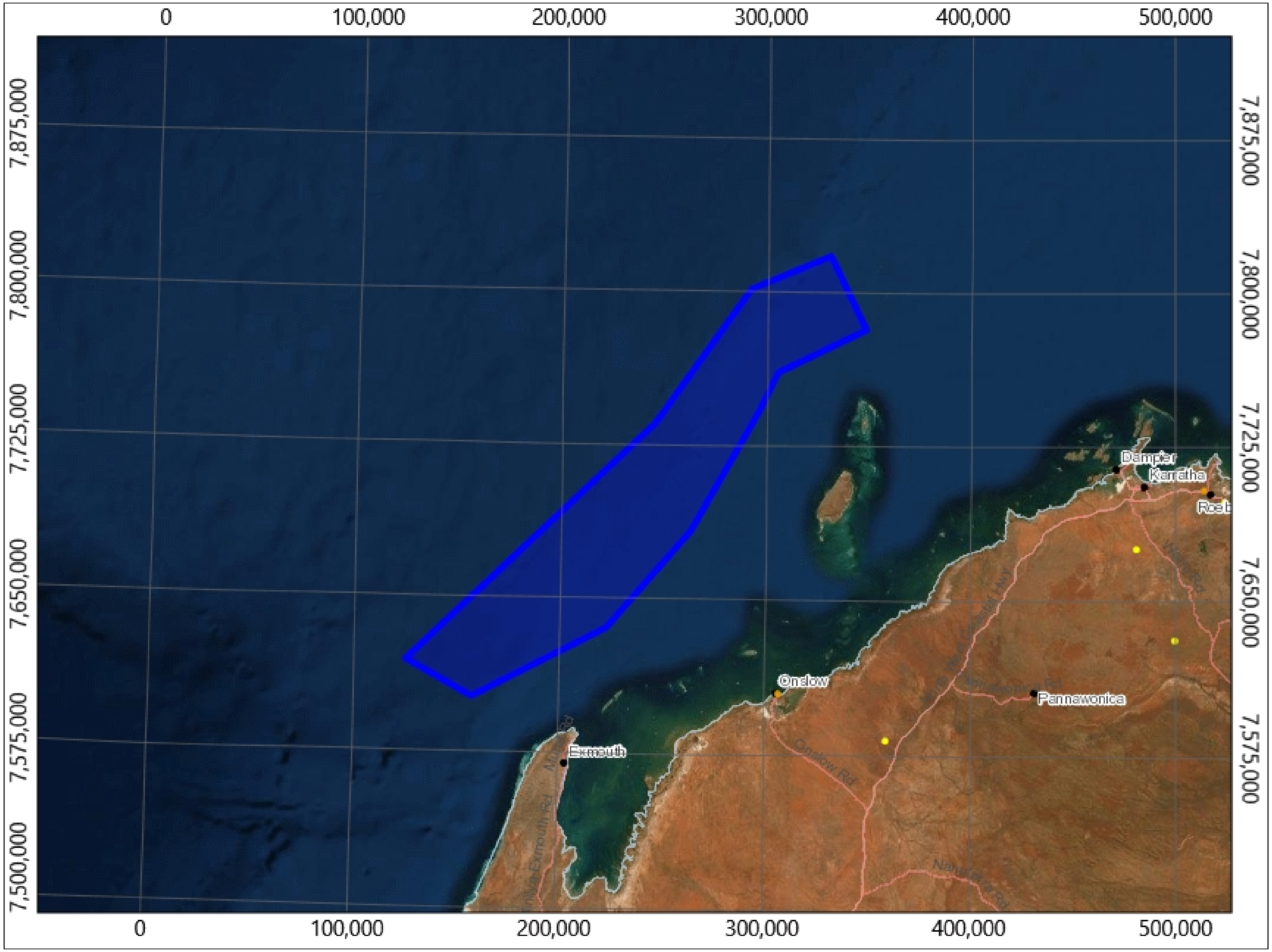
Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Heritage Inquiry System

Map of Registered Aboriginal Sites

For further important information on using this information please see the Department of Planning, Lands and Heritage's Disclaimer statement at https://www.dplh.wa.gov.au/about-this-website



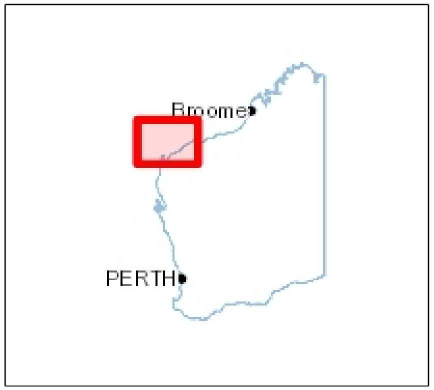
Legend

- Registered Aboriginal Site
- Search Area
- Town
- Road
- River
- Local Government Authority

99.54 kilometres

Map Scale 1 : 3,020,000

MGA Zone 50 (GDA94)



APPENDIX H: FIRST STRIKE PLAN

WA-49-L Gemtree Anchor Hold Testing – Oil Pollution First Strike Plan

Security and Emergency Management
Hydrocarbon Spill Preparedness Unit

December 2019
Revision: 0

TABLE OF CONTENTS

WA-49-L GEMTREE ANCHOR HOLD TEST OIL POLLUTION FIRST STRIKE PLAN

SPILL FROM FACILITY INCLUDING SUBSEA INFRASTRUCTURE

(Note: Pipe laying and accommodation vessels are considered a "FACILITY" under Australian Regs).

LEVEL 1

CONTROL AGENCY:	WOODSIDE
INCIDENT CONTROLLER:	Person In Charge (PIC) with support from Onshore Team Leader (OTL)

LEVEL 2 and 3

CONTROL AGENCY:	WOODSIDE
INCIDENT CONTROLLER:	CICC DUTY MANAGER

SPILL FROM FACILITY ENTERING STATE WATERS

LEVEL 1

CONTROL AGENCY:	WOODSIDE
INCIDENT CONTROLLER:	CICC DUTY MANAGER

LEVEL 2 and 3

CONTROL AGENCY:	DoT
INCIDENT CONTROLLER:	DoT IC

SPILL FROM VESSEL

(Note: SOPEP should be implemented in conjunction with this document)

LEVEL 1

CONTROL AGENCY:	AMSA
INCIDENT CONTROLLER:	VESSEL MASTER (with response assistance from Woodside)

LEVEL 2 and 3

CONTROL AGENCY:	AMSA
INCIDENT CONTROLLER:	AMSA (with response assistance from Woodside)

Guidance to Oil Spill Incident Levels

The most significant characteristic of the below guidance should be considered when determining level or escalation potential.

Characteristic	Level 1 Indicators	Level 2 Indicators	Level 3 Indicators
General Description	Generally able to be resolved within 24-48 hours.	Generally a response is required beyond 48 hours.	Response may extend beyond weeks.
Woodside Emergency Management (EM)/ EM)/Crisis Management Team (CMT) Activation	Onsite Incident Controller (IC) activated. Use of ICC support may be required.	Handover of Control from Onsite IC Corporate Incident Coordination Center (CICC) Duty Manager (DM) in Peth.	Includes Perth based CMT activation.
Number of Agencies	First-response agency and Incident Management Team (IMT).	Multi-agency response.	Agencies from across government and industry.
Environment	Isolated impacts or with natural recovery expected within weeks.	Significant impacts and recovery may take months.	Significant area and recovery may take months. Remediation required.
Economy	Business level disruption (i.e. Woodside).	Business failure or 'Channel' impacts.	Disruption to a sector.
Public Affairs	Local and regional media coverage (WA).	National media coverage.	International media coverage.

For guidance on credible spill scenarios and hydrocarbon characteristics refer to APPENDIX A – credible spill scenarios and hydrocarbon Information

For Spills Entering State Waters

In the event of a spill where Woodside is the responsible party and the spill may impact State waters/shorelines, Woodside will notify the Western Australian Department of Transport (DoT).

If the spill impacts State waters/shorelines and is a Level 1, Woodside will remain the Controlling Agency. If the spill is a Level 2/3 then DoT will become the Control Agency for the response in State waters/shorelines only. DoT will appoint an Incident Controller and form a separate Incident Management Team to manage the State waters/shorelines response only. The coordination structure for a concurrent hydrocarbon spill in both Commonwealth and State waters/shorelines is shown in APPENDIX E – Coordination structure for a concurrent hydrocarbon spill in both Commonwealth and State Waters/shorelines.

Initially Woodside will be required to make available an appropriate number of suitably qualified persons to work in the DoT IMT (see APPENDIX G – Woodside liason officer resources to DoT). DoT's role as the Controlling Agency for Level 2 and 3 spills in State waters/shorelines does not negate the requirement for Woodside to have appropriate plans and resources in place to adequately respond to a Marine Hydrocarbon Spill incident in State waters/shorelines or to commence the initial response actions to a spill prior to DoT establishing incident control in line with DoT Offshore Petroleum Industry Guidance Note - Marine Oil Pollution: Response and Consultation Arrangements (September 2018):

https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_StateHazardPlanMaritimeEnviroEmergMEE.pdf

Woodside's Incident Management Structure for a Hydrocarbon Spill, including Woodside Liaison Officer's command structure within DoT can be seen at APPENDIX F – Woodside incident management structure.

Response Process Overview

Use the below to determine which parts of this plan are relevant to the incident.

For guidance on credible scenarios and hydrocarbon characteristics, refer to APPENDIX A – credible spill scenarios and hydrocarbon Information**.**

Vessel Incident

Level 1

Implement Section 1, 2 and 4

Notify the WCC on [redacted] or sat phone [redacted]

Make relevant notifications in Table 1-1 of this Oil Pollution First Strike Plan.

Coordinate pre-identified tactics in Table 2-1 of this Oil Pollution First Strike Plan.

If the spill escalates such that the site cannot manage the incident inform the WCC on [redacted] or sat phone [redacted] and escalate to a level 2/3 incident.

Handover control to AMSA.

Level 2/3

Implement Section 1

Notify the WCC on [redacted] or sat phone [redacted] to stand up the CICC.

CICC DM to coordinate relevant notifications in Table 1-1 of this Oil Pollution First Strike Plan.

If requested by AMSA implement sections 3 and 4 (continue below)

Undertake quick revalidation of the recommended strategies on Table 3-1 taking into consideration seasonal sensitivities and current situational awareness.

Undertake validated strategies.

Create an IAP for all ongoing operational periods

The content of the IAP should reflect the selected response strategies based on current situational awareness.

For the full detailed pre-operational NEBA see Click Here or see Appendix A of the OSPRMA

1. NOTIFICATIONS (ALL LEVELS)

The Incident Controller or delegate must ensure the below notifications Table 1-1 are completed within the designated timeframes.

For other environmental notifications required refer to the *WA-49-L Gemtree Anchor Hold Testing Environment Plan*.

Table 1-1: Immediate Notifications

Notification timing	Responsibility	Authority /Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
Notifications to be made for ALL LEVELS of spill *(For spills from a vessel the following notifications must be undertaken by a WEL representative).*							
Immediately	Vessel Master	Woodside Communication Centre (WCC)	Duty Manager	[redacted] or [redacted] or Sat phone: [redacted]	Verbally notify WCC of event and estimated volume and hydrocarbon type.	Verbal	
Within 2 hours	Woodside Site Rep (WSR)	National Offshore Petroleum Safety Environmental Management Authority (NOPSEMA[1])	Incident notification office	[redacted]	Verbally notify NOPSEMA for spills >80L. Record notification using Initial Verbal Notification Form or equivalent and send to NOPSEMA as soon as practicable (cc to ational Offshore Petroleum Titles Administrator (NOPTA) and Department of Mines, Industry Regulation and Safety (DMIRS).	App B Form 1	
Within 3 days	WSR				Provide a written NOPSEMA Incident Report Form as soon as practicable (no later than 3 days after notification) (cc to NOPTA and DMIRS).	App B Form 2	

[1] Notification to NOPSEMA must be from a Woodside Representative.

Notification timing	Responsibility	Authority /Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
					NOPSEMA: submissions@nopsema.gov.au NOPTA: resources@nopta.gov.au DMIRS: petreps@dmirs.wa.gov.au		
As soon as practicable	WSR	Woodside	Hydrocarbon Spill Preparedness Manager	[redacted]	Verbally notify Hydrocarbon Spill Preparedness (HSP) Manager of event and estimated volume and hydrocarbon type.	Verbal	
As soon as practicable	CICC DM or Delegate	Woodside	Environment Duty Manager	As per roster	Verbally notify Duty Environment of event and seek advice on relevant performance tandards from EP.	Verbal	
As soon as practicable	CICC DM or Delegate	Department of Environment and Energy	Director of National Parks (Director)	+61 8 6274 2220	The Director is notified in the event of oil pollution within a marine park, or where an oil spill response action must be taken within a marine park, so far as reasonably practicable, prior to response action being taken.	Verbal	
Without delay as per protection of the Sea Act, part II, section 11(1)	Vessel Master	Australian Maritime Safety Authority (AMSA)	Response Coordination Centre (RCC)	1800 641 792 or +61 2 6230 6811	Verbally notify AMSA RCC of the hydrocarbon spill. Follow up with a written Marine Pollution Report (POLREP) as soon as practicable following verbal notification.	App B Form 3	
ADDITIONAL LEVEL 2/3 NOTIFICATIONS							
As soon as practicable	CICC DM or Delegate	AMOSC	AMOSC Duty Manager	+61 438 379 328	Notify AMOSC that a spill has occurred and follow-up with an email from the IC/CICC DM, CMT	App B Form 4	

Notification timing	Responsibility	Authority /Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
					Leader or Oil Spill Preparedness Manager to formally activate AMOSC. Determine what resources are required consistent with the AMOSPlan and detail in a Service Contract that will be sent to Woodside from AMOSC upon activation.		
As soon as practicable	CICC DM or Delegate	Oil Spill Response Limited (OSRL)	OSRL Duty Manager	+65 6266 1566	Contact OSRL Duty Manager and request assistance from technical advisor in Perth. Send the notification form to OSRL as soon as practicable. For mobilisation of resources, send the Mobilisation Form to OSRL as soon as practicable.	Notification: App B Form 6a Mobilisation: App B Form 6b	
As soon as practicable or if spill is likely to extend into WA State waters.	CICC DM or Delegate	WA Department of Transport	DOT Duty Manager	08 9480 9924	Marine Duty Manager to verbally notify DoT that a spill has occurred and request use of equipment stored in the Exmouth supply shed at Harold E Holt. Follow up with a written POLREP as soon as practicable following verbal notification. Additionally DoT to be notified if spill is likely to extend into WA State waters. Request DoT to provide Liaison to WEL IMT.	App B Form 5	

Notification timing	Responsibility	Authority /Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
As soon as practicable if there is potential for oiled wildlife or the spill is expected to contact land or waters managed by WA Department of Biodiversity, Conservation and Attractions	CICC DM or Delegate	WA Department of Biodiversity, Conservation and Attractions (DBCA)	Duty Officer	08 9219 9108	Phone call notification.	Verbal	
As soon as practicable	CICC DM or Delegate	Marine Spill Response Corporation (MSRC)	MSRC Response Manager	+1-732-417-0175 or +1-703-326-5609	Activate the contract with MSRC (in full) for the provision of up to 30 personnel depending on what skills are required. Please note that provision of these personnel from MSRC are on a best endeavours basis and are not guaranteed.	Verbal	

2. LEVEL 1 RESPONSE

2.1 Mobilisation of response techniques

For the relevant hydrocarbon type, undertake quick revalidation of the recommended techniques and pre-identified tactics indicated with a ‘Yes’ in Table 2-1. Undertake all validated pre-identified tactics immediately. These tactics should be carried out using the associated plan identified under Table 2-1 Operational Plan column.

All response techniques and pre-identified tactics have been identified from the pre-operational Net Environmental Benefits Analysis (NEBA) presented in the WA-49-L Gemtree Anchor Hold Testing Environment Plan Appendix D: Oil Spill Preparedness and Response Mitigation Assessment.

Table 2-1: Level 1 Response Summary

Response Techniques	Hydrocarbon Type Marine Diesel Oil	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
Monitor and evaluate – tracking buoy (OM02)	Yes	If a vessel is on location, consider the need to deploy the oil spill tracking buoy. If no vessel is on location consider the need to mobilise oil spill tracking buoys from the King Bay Supply Base (KBSB) Stockpile. If a surface sheen is visible from the facility deploy the satellite tracking buoy within 2 hours.	Operations	**DAY 1:** Tracking buoy deployed within two hours.		Surveillance and Reconnaissance to Detect Hydrocarbons and Resources at Risk (OM02) of The Operational Monitoring Operational Plan. Deploy tracking buoy in accordance with APPENDIX D – Tracking buoy deployment instructions.
Please consider instructing the CICC DM to activate or implement any of the following Pre-Identified tactics. The following tactics will assist in answering the '7 Questions of Spill Assessment' identified in Appendix C to increase situational awareness.						
Monitor and evaluate – predictive modelling (OM01)	Yes	Undertake initial modelling using the Rapid assessment oil spill tool and weathering fate analysis using ADIOS (or refer to the hydrocarbon information in APPENDIX A – credible spill scenarios and hydrocarbon Information).	Intelligence or Environment	**DAY 1:** Initial modelling within six hours using the Rapid Assessment Tool.		Predictive Modelling of Hydrocarbons to Assess Resources at Risk (OM01 of the Operational Monitoring Operational Plan. *Planning to download immediately and follow steps*
	Yes	Send Oil Spill Trajectory Modelling (OSTM) form (APPENDIX B – Forms Form 7) to RPS APASA response team (email response@apasa.com.au) and call +61 755741112	Intelligence	**DAY 1:** Detailed modelling within four hours of APASA receiving information from Woodside.		
Monitor and evaluate – aerial surveillance (OM02)	Yes	Instruct Aviation Duty Manager to commence aerial observations in daylight hours. Aerial surveillance observer to	Logistics - Aviation	**DAY 1:** Two trained aerial observers. One aircraft available.		Surveillance and Reconnaissance to Detect Hydrocarbons and Resources at Risk (OM02 of The Operational Monitoring Operational Plan).

Response Techniques	Hydrocarbon Type Marine Diesel Oil	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
		complete log in APPENDIX B – Forms Form 8.		Report made available to the IMT within two hours of landing after each sortie.		*Planning to download immediately and follow steps*
Monitor and evaluate – satellite tracking (OM02)	Yes	The Intelligence Duty Manager should be instructed to stand up KSAT to provide satellite imagery of the spill.	Intelligence	**DAY 1:** Service provider will confirm availability of an initial acquisition within two hours. Data received to be uploaded into Woodside Common Operating Picture		
Monitor and evaluate – monitoring hydrocarbons in water (OM03)	Yes	Consider the need to mobilise resources to undertake water quality monitoring (OM03).	Planning or Environment	**DAY 3:** Water quality assessment access and capability. Daily fluorometry reports will be provided to IMT.		Detecting and Monitoring for the Presence and Properties of Hydrocarbons in the Marine Environment (OM03 of The Operational Monitoring Operational Plan).
Monitor and evaluate – pre-emptive assessment of receptors at risk (OM04)	Yes	Consider the need to mobilise resources to undertake pre-emptive assessment of sensitive receptors at risk (OM04).	Planning or Environment	**DAY 2:** In agreement with WA DoT, deployment of two specialists for each of the Response Protection Areas (RPA) with predicted impacts.		Pre-emptive Assessment of Sensitive Receptors at rRsk (OM04 of The Operational Monitoring Operational Plan).
Monitor and evaluate – shoreline assessment (OM05)	Yes	Consider the need to mobilise resources to undertake shoreline assessment surveys (OM05).	Planning or Environment	**DAY 2:** In agreement with WA DoT, deployment of one specialist in SCAT for each of the RPAs with predicted impacts.		Monitoring of contaminated resources (OM05 of The Operational Monitoring Operational Plan).

3. LEVEL 2/3 RESPONSE

3.1 Mobilisation of response techniques

For the relevant hydrocarbon type, undertake quick revalidation of the recommended techniques and pre-identified tactics indicated with a ‘Yes’ in Table 3-1. Undertake all validated pre-identified tactics immediately. These tactics should be carried out using the associated plan identified under Table 3-1 Operational Plan column.

All response techniques and pre-identified tactics have been identified from the pre-operational Net Environmental Benefits Analysis (NEBA) presented in the WA-49-L Gemtree Anchor Hold Testing Environment Plan Appendix D: Oil Spill Preparedness and Response Mitigation Assessment.

Table 3-1: Level 2/3 Response Summary

Response Techniques	Hydrocarbon Type Marine Diesel Oil	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
Monitor and evaluate – predictive modelling (OM01)	Yes	Undertake initial modelling using the Rapid assessment oil spill tool and weathering fate analysis using ADIOS (or refer to the hydrocarbon information in APPENDIX A – credible spill scenarios and hydrocarbon Information).	Intelligence or Environment	**DAY 1:** Initial modelling within six hours using the Rapid Assessment Tool.		Predictive Modelling of Hydrocarbons to Assess Resources at Risk (OM01 of The Operational Monitoring Operational Plan. *Planning to download immediately and follow steps*
	Yes	Send Oil Spill Trajectory Modelling (OSTM) form (APPENDIX B – Forms Form 7) to RPS APASA response team (email response@apasa.com.au) and call +61 755741112	Intelligence	**DAY 1:** Detailed modelling within four hours of APASA receiving information from Woodside.		
Monitor and evaluate – tracking buoy (OM02)	Yes	If a vessel is on location, consider the need to deploy the oil spill tracking buoy. If no vessel is on location consider the need to mobilise oil spill tracking buoys from the King Bay Supply Base (KBSB) Stockpile. If a surface sheen is visible from the facility deploy the satellite tracking buoy within 2 hours.	Operations	**DAY 1:** Tracking buoy deployed within two hours.		Surveillance and Reconnaissance to Detect Hydrocarbons and Resources at Risk (OM02) of The Operational Monitoring Operational Plan. Deploy tracking buoy in accordance with APPENDIX D – Tracking buoy deployment instructions.
Monitor and evaluate – aerial surveillance (OM02)	Yes	Instruct Aviation Duty Manager to commence aerial observations in daylight hours. Aerial surveillance observer to complete log in APPENDIX B – Forms Form 8.	Logistics - Aviation	**DAY 1:** Two trained aerial observers. One aircraft available. Report made available to the IMT within two hours of landing after each sortie.		Surveillance and Reconnaissance to Detect Hydrocarbons and Resources at Risk (OM02 of The Operational Monitoring Operational Plan). *Planning to download immediately and follow steps*
Monitor and evaluate – satellite	Yes	The Intelligence Duty Manager should be instructed to stand up Kongsberg Satellite Services (KSAT) to provide satellite imagery of the spill.	Intelligence	**DAY 1:** Service provider will confirm availability of an initial acquisition within two hours.		

Response Techniques	Hydrocarbon Type Marine Diesel Oil	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
tracking (OM02)				Data received to be uploaded into Woodside Common Operating Picture.		
Monitor and evaluate – monitoring hydrocarbons in water (OM03)	Yes	Consider the need to mobilise resources to undertake water quality monitoring (OM03).	Planning or Environment	**DAY 3:** Water quality assessment access and capability Daily fluorometry reports will be provided to IMT.		Detecting and Monitoring for the Presence and Properties of Hydrocarbons in the Marine Environment (OM03 of The Operational Monitoring Operational Plan).
Monitor and evaluate – pre-emptive assessment of receptors at risk (OM04)	Yes	Consider the need to mobilise resources to undertake pre-emptive assessment of sensitive receptors at risk (OM04).	Planning or Environment	**DAY 2:** In agreement with WA DoT, deployment of two specialists for each of the Response Protection Areas (RPA) with predicted impacts.		Pre-emptive Assessment of Sensitive Receptors (OM04) of The Operational Monitoring Operational Plan.
Monitor and evaluate – shoreline assessment (OM05)	Yes	Consider the need to mobilise resources to undertake shoreline assessment surveys (OM05).	Planning or Environment	**DAY 2:** In agreement with WA DoT, deployment of one specialist in SCAT for each of the RPAs with predicted impacts.		Shoreline Assessment (OM05) of The Operational Monitoring Operational Plan.
Surface Dispersant	No	This technique is not recommended. Surface dispersant application is not appropriate for marine diesel.				
Mechanical Dispersion	No	This technique is not recommended. Although feasible, highly volatile hydrocarbons are likely to weather, spread and evaporate quickly and lead to unsafe conditions in the vicinity of fresh hydrocarbon. Additionally, vessels used for mechanical dispersion would be contaminated by the hydrocarbon and				

Response Techniques	Hydrocarbon Type Marine Diesel Oil	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
		could cause secondary contamination of unimpacted areas.				
In-situ Burning	**No**	This technique is not recommended. It requires calm sea state conditions which limits its feasibility in the region. Additionally, there are health and safety risks for response personnel associated with the containment and subsequent burning of hydrocarbons and the residue from attempts to burn would sink, posing a risk to the environment.				
Containment and Recovery	**No**	This technique is not recommended. Containment and recovery is not feasible for marine diesel due to rapid spreading and evaporation together with potentially high levels of volatiles from such a spill.				
Shoreline Protection and Deflection	**No**	A marine diesel spill would be prone to rapid spreading and evaporation and modelling predicts that no shoreline receptors will be contacted at threshold. Floating oil concentrations are minimal and would not allow for feasible or effective protection and deflection operations. The volatile nature of marine diesel is also likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon.				
Shoreline Clean Up	**No**	A marine diesel spill would be prone to rapid spreading and evaporation and modelling predicts that no shoreline receptors will be contacted at threshold - any minor contact is significantly below				

Response Techniques	Hydrocarbon Type Marine Diesel Oil	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
		any threshold concentration that would allow a feasible or effective response.				
Oiled Wildlife Response	Yes	If oiled wildlife is a potential impact, request AMOSC to mobilise containerised oiled wildlife first strike kits and relevant personnel. Refer to relevant Tactical Response Plan for potential wildlife at risk. Mobilise AMOSC Oiled Wildlife Containers. Consider whether additional equipment is required from local suppliers.	Logistics and Planning			Oiled Wildlife Response Operational Plan
Scientific Monitoring (Type II)	Yes	Notify Woodside science team of spill event.	Environment			Oil Spill Scientific Monitoring Programme – Operational Plan

4. PRIORITY RECEPTORS

Note: DoT are the Control Agency to respond to all the sites listed below in a Level 2/3 spill into State waters/shorelines.

Action: Provide DoT with all relevant Tactical Response Plans for these locations.

Based on hydrocarbon spill risk modelling results the sensitive receptors outlined in Table 4-2 are identified as priority protection areas, as they have the potential to be contacted by hydrocarbon at or above impact threshold levels within 48 hours of a spill. Please note that impact thresholds (10 g/m^2 surface hydrocarbon concentration, 100 g/m^2 shoreline accumulation, and 500 ppb entrained hydrocarbon concentration) used to determine the 'environment that may be affected' (EMBA) identified in the Environment Plan are lower than the response thresholds (Table 4-1).

Table 4-1: Response Thresholds

Surface Hydrocarbon (g/m^2)	Description
>10	Predicted minimum threshold for commencing operational monitoring [2]
50	Predicted minimum floating oil threshold for containment and recovery and surface dispersant application [3]
100	Predicted optimum floating oil threshold for containment and recovery and surface dispersant application
250	Predicted minimum threshold for commencing shoreline clean-up operations

Table 4-2: Receptors for Priority Protection.

Receptor	Distance and Direction from Gemtree exploration well	Threshold triggered and recommended strategy	Tactical Response Plans (also available within the Data Directory)
Montebello Marine Park	11 km SE	Threshold: >50 g/m^2 Strategies: Monitor the slick to assess if any shoreline RPAs become at risk of impact. *N.B. No shoreline impact is predicted at response thresholds. Additionally, although this RPA has surface concentrations at the >50 g/m^2 threshold, dispersant and containment and recovery are not feasible for a spill of marine diesel as detailed* in Table 3-1.	N/A – offshore receptor.

[2] Operational monitoring will be undertaken from the outset of a spill whether or not this threshold has been reached. Monitoring is needed throughout the response to assess the nature of the spill, track its location and inform the need for any additional monitoring and/or response techniques. It also informs when the spill has entered State Waters and/or control of the incident passes to statutory authorities e.g. WA DoT or AMSA.

[3] At 50g/m^2 containment and recovery and surface dispsearant application operations are not expected to be particularly effective. This threshold represents a conservative approach to planning response capability and displaying the spread of surface oil.

Hydrocarbon spill modelling results indicate the sensitive receptors listed below have the potential to be contacted by hydrocarbons beyond 48 hours of a spill, although contact is below response thresholds in all cases thus the main technique required will be monitor and evaluate:

- Ningaloo Coast (North/North West Cape, Middle and South) World Heritage Area and State Marine Park
- Montebello Islands and State Marine Park
- Barrow Island
- Lowendal Islands
- Argo-Rowley Terrace Marine Park
- Muiron Islands World Heritage Area and State Marine Park
- Rankin Bank
- Glomar Shoals

Tactical Response plans for these locations can be accessed via the Oil Spill Portal - Tactical Response Plans.

Oil spill trajectory modelling specific to the spill event will be required to determine the regional sensitive receptors to be contacted beyond 48 hours of a spill.

Figure 4-1 llustrates the location of regional sensitive receptors in relation to the WA-49-L Gemtree Anchor Hold Testing operational area and identifies priority protection areas.

Consideration should be given to other stakeholders (including mariners) in the vicinity of the spill location. Table 4-3 indicates the assets within the vicinity of the WA-49-L Gemtree Anchor Hold Testing operational area.

Table 4-3: Assets in the vicinity of the WA-49-L Gemtree Anchor Hold Testing operational area

Asset	Distance and Direction from WA-49-L Gemtree exploration well	Operator
Pluto Platform	21 km ENE	Woodside
Wheatstone Platform	28 km NE	Chevron
John Brookes	35 km S	Santos
East Spar	61 km S	Santos
Goodwyn	91 km NE	Woodside
North Rankin	113 km NE	Woodside

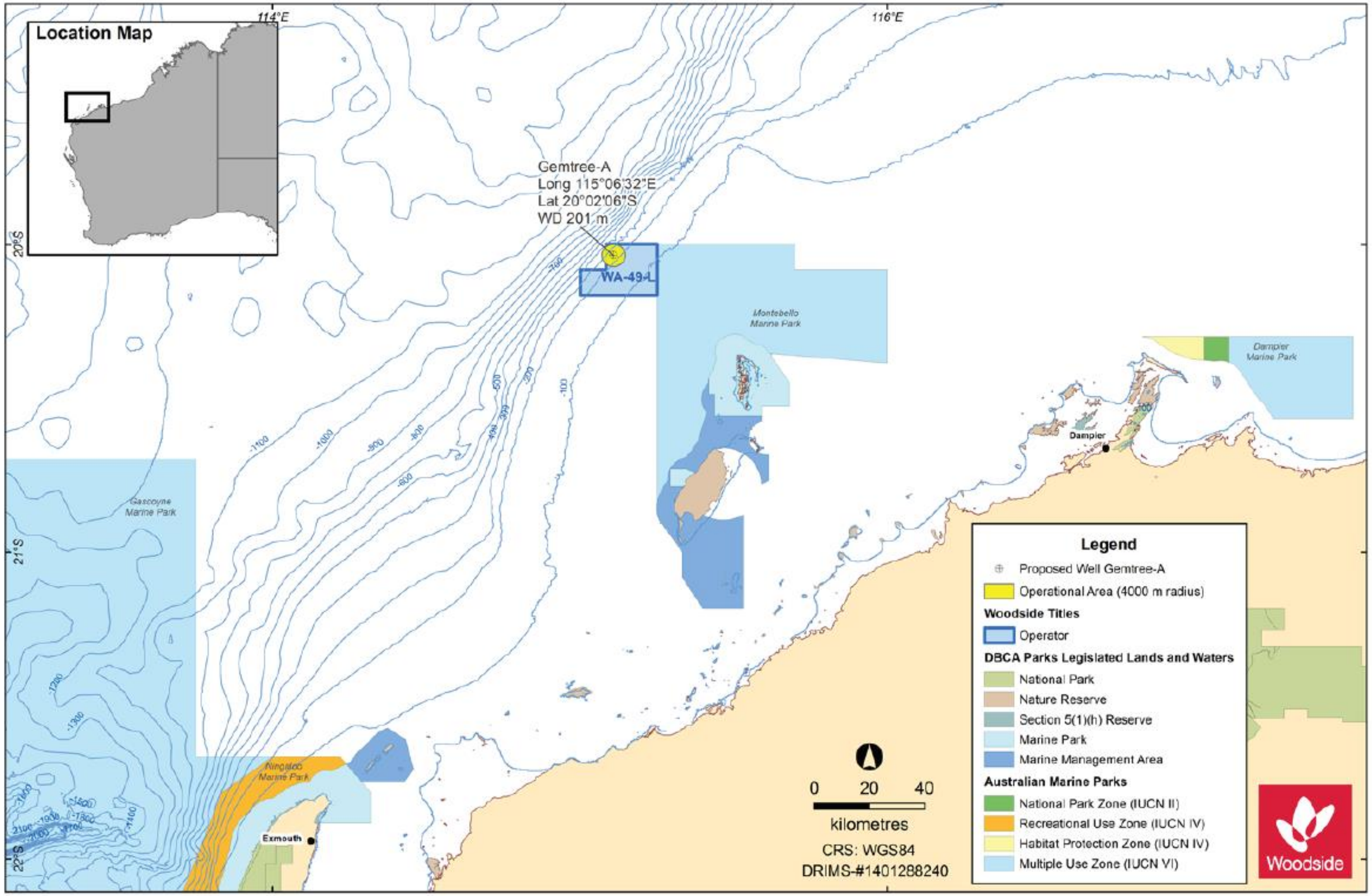


Figure 4-1: Regional Sensitive Receptors – WA-49-L Gemtree Anchor Hold Testing operational area

5. DISPERSANT APPLICATION

Dispersant is not considered an appropriate response technique for this activity as described in WA-49-L Gemtree Anchor Hold Testing Environment Plan Appendix D: Oil Spill Preparedness and Response Mitigation Assessment.

APPENDIX A – CREDIBLE SPILL SCENARIOS AND HYDROCARBON INFORMATION

For more detailed hydrocarbon information see the
Hydrocarbon Data Directory

Credible Spill Scenarios

Scenario	Product	Maximum Volumes	Suggested ADIOS2 Analogue*
MEE-01: Hydrocarbon release due to vessel collision (instantaneous surface release)	Marine diesel (API of 37.2°)	275 m^3 (5% residue of 13.75 m^3)	Diesel Fuel Oil (Southern USA 1) (API of 37.2°)

**Initial screening of possible ADIOS2 analogues was done by considering hydrocarbons with similar APIs. Suggested selection was based on the closest distillation cut to WEL hydrocarbon. Only hydrocarbons with distillation cuts that showed results for > 380°C were included in selection process.*

Marine diesel

Marine diesel is a mixture of volatile and persistent hydrocarbons with low proportions of highly volatile and residual components. In general, about 6% of the oil mass should evaporate within the first 12 hours (BP < 180°C); a further 35% should evaporate within the first 24 hours (180°C < BP < 265°C); and a further 54% should evaporate over several days (265°C < BP < 380°C). Approximately 5% of the oil is shown to be persistent. The aromatic content of the oil is approximately 3%.

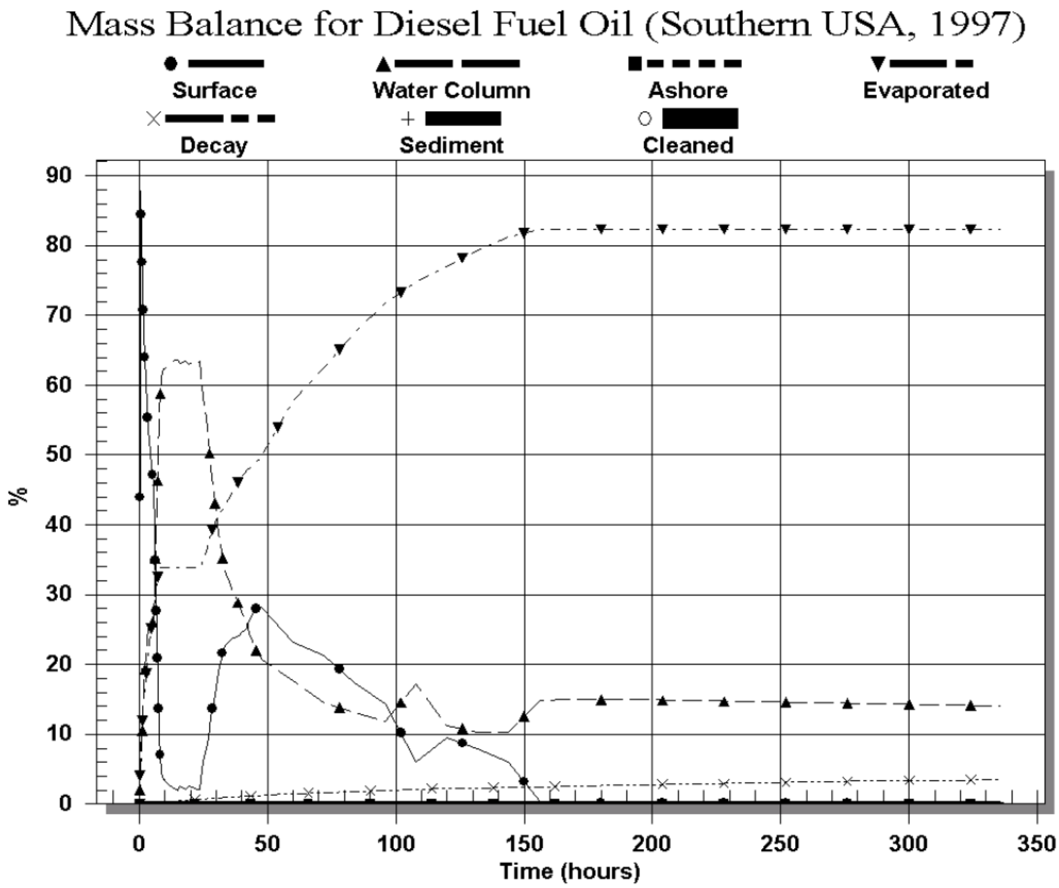


Figure A - 1: Predictions for the partitioning of oil mass over time through weathering processes for diesel fuel oil. Predictions are based on sample environmental conditions.

Source: Data available from the APASA oil database (Diesel Fuel Oil (Southern USA 1997)). NOTE: This information is provided as guidance only. Spill event OSTM should be sought.

APPENDIX B – FORMS

Form No.	Form Name	Link
1	Record of Initial Verbal Notification to NOPSEMA Template	Link
2	NOPSEMA Incident Report Form	Link
3	Marine Pollution Report (POLREP – AMSA)	Link
4	AMOSC Service Contract Note	Link
5	Marine Pollution Report (POLREP – DoT)	Link
6a	OSRL Initial Notification Form	Link
6b	OSRL Mobilisation Activation Form	Link
7	APASA Oil Spill Trajectory Modelling Request	Link
8	Aerial Surveillance Observer Log	Link

FORM 1

Record of initial verbal notification to NOPSEMA

Woodside

____

(NOPSEMA ph: (08) 6461 7090)

Date of call	
Time of call	
Call made by	
Call made to	

Information to be provided to NOPSEMA:

Date and Time of incident/time caller became aware of incident	
Details of incident	1. **Location** ____________ 2. **Title**____________ 3. **Hydrocarbon source** □ **Platform**____________ □ **Pipeline**____________ □ **FPSO**____________ □ **Exploration drilling**____________ □ **Well**____________ □ **Other (please specify)** ____________ 4. **Hydrocarbon type**____________ 5. **Estimated volume of hydrocarbon** ____________ 6. **Has the discharge ceased?**____________ 7. **Fire, explosion or collision?** ____________ 8. **Environment Plan(s)** ____________ 9. **Other Details**____________

Actions taken to avoid or mitigate environmental impacts	
Corrective actions taken or proposed to stop, control or remedy the incident	

After the initial call is made to NOPSEMA, please send this record as soon as practicable to:

1. **NOPSEMA** **submissions@nopsema.gov.au**
2. **NOPTA** **resources@nopta.gov.au**
3. **DMIRS** **petreps@dmirs.wa.gov.au**

FORM 2

[for exploration/development activities]
[insert NOPSEMA Incident Report Form when printing]
Link

FORM 3

[insert Marine Pollution Report (POLREP – AMSA) when printing]
Link

FORM 4

[insert AMOSC Service Contract note when printing]

Link

FORM 5

[insert Marine Pollution Report (POLREP – DoT) when printing]
Link

FORM 6a

[insert OSRL Initial Notification Form when printing]
Link

FORM 6b

[insert OSRL Mobilisation Activation Form when printing]
Link

FORM 7

[insert APASA Oil Spill Trajectory Modelling Request form when printing]
Link

FORM 8

[insert Aerial Surveillance Observer Log when printing]

Link

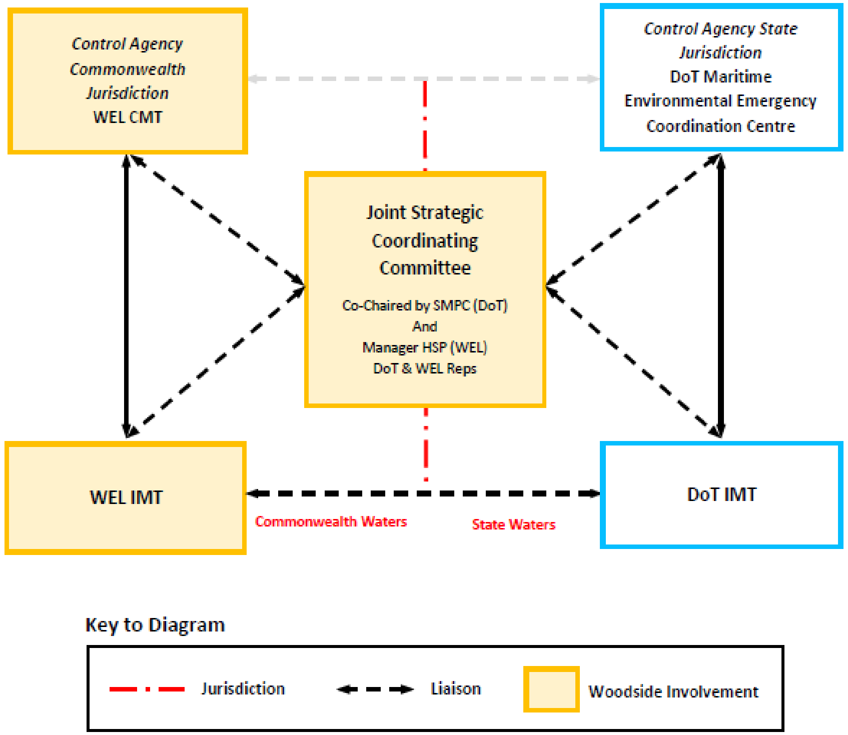
APPENDIX C – 7 QUESTIONS OF SPILL ASSESSMENT

WHAT IS IT? **Oil Type/name** **Oil properties** **Specific gravity / viscosity / pour point / asphphaltines / wax content / boiling point**	
WHERE IS IT? Lat/Long Distance and bearing	
HOW BIG IS IT? Area Volume	
WHERE IT IS GOING? Weather conditions Currents and tides	
WHAT IS IN THE WAY? Resources at risk	
WHEN WILL IT GET THERE? Weather conditions Currents and tides	
WHAT'S HAPPENING TO IT? Weathering processes	

APPENDIX D – TRACKING BUOY DEPLOYMENT INSTRUCTIONS

(Insert Link when printing)

APPENDIX E – COORDINATION STRUCTURE FOR A CONCURRENT HYDROCARBON SPILL IN BOTH COMMONWEALTH AND STATE WATERS/SHORELINES[4]

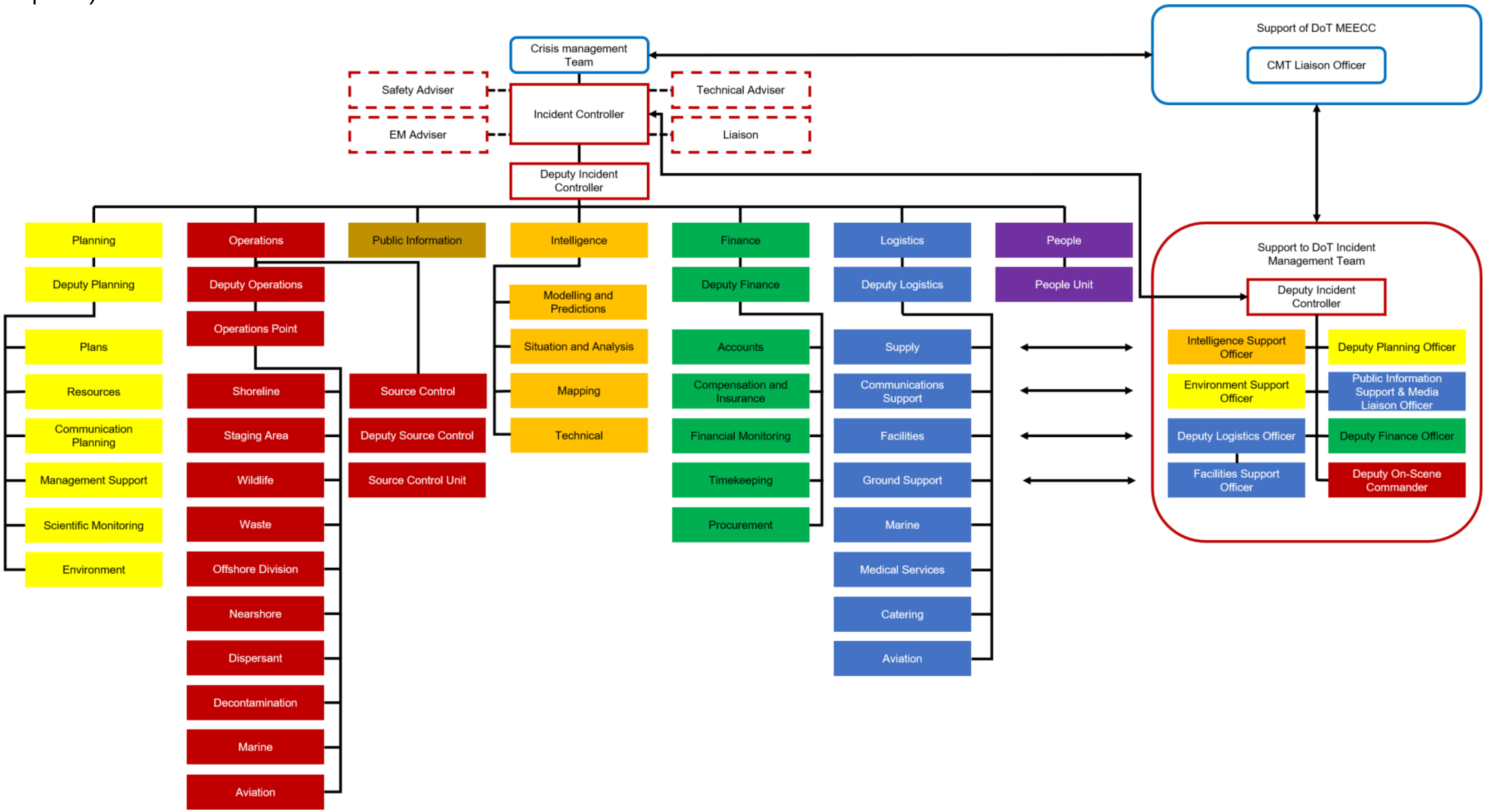


The Control Agency for a Level 1 hydrocarbon spill in Commonwealth waters resulting from an offshore petroleum activity is Woodside (the Petroleum Titleholder). The Control Agency for a Level 2/3 hydrocarbon spill in State waters/shorelines resulting from an offshore petroleum activity is DoT. DoT will appoint an Incident Controller and form a separate IMT to only manage the spill within State waters/shorelines.

[4] Adapted from DoT Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: Response and Consultation Arrangements January 2017. Note: For full structure up to Commonwealth Cabinet/Minister refer to OPEA (Aust) LInk Section 4.3.3.

APPENDIX F – WOODSIDE INCIDENT MANAGEMENT STRUCTURE

Woodside Incident Management Structure for Hydrocarbon Spill (including Woodside Liaison Officers Command Structure within DoT IMT if required).



APPENDIX G – WOODSIDE LIASON OFFICER RESOURCES TO DOT

Once DoT activates a State waters/shorelines IMT, Woodside will make available the following roles to DoT.

Area	WEL Liaison Role	Personnel Sourced from[5]:	Key Duties	#
DoT MEECC	CMT Liaison Officer	CMT Duty Managers Roster	• Provide a direct liaison between the CMT and the MEECC. • Facilitate effective communications and coordination between the CMT and State Maritime Environment Emergency Coordinator (SMEEC). • Offer advice to SMEEC on matters pertaining to Petroleum Titleholder (PT) crisis management policies and procedures.	1
DoT IMT Incident Control	WEL Deputy Incident Controller	CICC Duty Managers Reserve List Roster	• Provide a direct liaison between the PT IMT and DoT IMT. • Facilitate effective communications and coordination between the PT IC and the DoT IC. • Offer advice to the DoT IC on matters pertaining to PT incident response policies and procedures. • Offer advice to the Safety Coordinator on matters pertaining to PT safety policies and procedures, particularly as they relate to PT employees or contractors operating under the control of the DoT IMT.	1
DoT IMT Planning-Intelligence/ Mapping	Intelligence Support Officer	AMOSC Staff Member or AMOSC Core Group	• Facilitate the provision of relevant modelling and predications from the PT IMT. • Assist in the interpretation of modelling and predictions originating from the PT IMT. • Facilitate the provision of relevant situation and awareness information originating from the DoT IMT to the PT IMT. • Facilitate the provision of relevant mapping from the PT IMT. • Assist in the interpretation of mapping originating from the PT IMT. • Facilitate the provision of relevant mapping originating from the DoT IMT to the PT IMT.	1
DoT IMT Planning-Plans/ Resources	Deputy Planning Officer	AMOSC Core Group/CICC Planning Coordinator Reserve List and Planning Group 3	• Facilitate the provision of relevant IAP and sub plans from the PT IMT. • Assist in the interpretation of the PT OPEP from the PT. • Assist in the interpretation of the PT IAP and sub plans from the PT IMT. • Facilitate the provision of relevant IAP and sub plans originating from the DoT IMT to the PT IMT. • Assist in the interpretation of the PT existing resource plans. • Facilitate the provision of relevant components of the resource sub plan originating from the DoT IMT to the PT IMT.	1

[5] See Combined CICC, KICC, CMT roster and Preparedness Schedule Link / AMOSC Service Contract Link

Area	WEL Liaison Role	Personnel Sourced from[5]:	Key Duties	#
DoT IMT Planning-Environment	Environment Support Officer	CMT Environmental FST Duty Managers Roster	• Assist in the interpretation of the PT OPEP and relevant TRP plans. • Facilitate in requesting, obtaining and interpreting environmental monitoring data originating from the PT IMT. • Facilitate the provision of relevant environmental information and advice originating from the DoT IMT to the PT IMT.	1
DoT IMT Public Information-Media/ Community Engagement	Public Information Support and Media Liaison Officer	CMT Reputation {Media} FST Duty Manager Roster	• Facilitate effective communications and coordination between the PT and DoT media teams. • Assist in the release of joint media statements and conduct of joint media briefings. • Assist in the release of joint information and warnings through the DoT Information and Warnings team. • Offer advice to the DoT Media Coordinator on matters pertaining to PT media policies and procedures. • Facilitate effective communications and coordination between the PT and DoT Community Liaison teams. • Assist in the conduct of joint community briefings and events. • Offer advice to the DoT Community Liaison Coordinator on matters pertaining to the PT community liaison policies and procedures. • Facilitate the effective transfer of relevant information obtained from through the Contact Centre to the PT IMT.	1
DoT IMT Logistics-Supply	Deputy Logistic Officer	CMT Services FST Logistics Team 2 Roster	• Facilitate the acquisition of appropriate supplies through the PTs existing OSRL, AMOSC and private contract arrangements. • Collects Request Forms from DoT to action via PT IMT.	1
DoT IMT Logistics-Waste	Facilities Support Officer	CMT Services FST Logistics Team 2 and WEL Waste Contractor Roster	• Facilitate the acquisition of appropriate services and supplies through the PTs existing private contract arrangements related to waste management. • Collects Request Forms from DoT to action via PT IMT.	1
DoT IMT Finance-Accounts/ Financial Monitoring	Deputy Finance Officer	CICC Finance Coordinator Roster	• As part of the Finance Team, assist the Finance Officer in the performance of their duties in relation to the setting up and payment of accounts for those services acquired through Woodside's existing OSRL, AMOSC and private contract arrangements. • Facilitate the communications of financial monitoring information to Woodside to allow Woodside to track the overall cost of the response. • Assist the finance office in the tracking of financial commitments thought he response, including the supply contracts commissioned directly and to be charged back to Woodside.	1

Area	WEL Liaison Role	Personnel Sourced from[5]:	Key Duties	#
DoT FOB Operations Command	Deputy On-Scene Commander	AMOSC Core Group	• Provide a direct liaison between the PT FOB and DoT FOB. • Facilitate effective communications and coordination between the PT FOB Operations Commander and the DoT FOB Operations Commander. • Offer advice to the DoT FOB Operations Commander on matters pertaining to PT incident response policies and procedures. • Assist the Senior Safety Officer deployed in the FOB in the performance of their duties, particularly as they relate to PT employees or contractors. • Offer advice to the Senior Safety Officer deployed in the FOB on matters pertaining to PT safety policies and procedures.	1
			Total Woodside Personnel Initial Requirement to DoT IMT	10

DOT LIAISON OFFICER RESOURCES TO WOODSIDE

Once DoT activates a State waters/shorelines IMT, DoT will make available the following roles to Woodside:

Area	DoT Liaison Role	Personnel Sourced from:	Key Duties	#
WEL CMT	DoT Liaison Officer	DoT	• Provide a direct liaison via CICC HSP Advisor between the CMT and the MEECC. • Facilitate effective communications and coordination between the CMT Leader and SMEEC. • Offer advice to CMT Leader on matters pertaining to DoT and wider government emergency management policies and procedures. • Provide a direct liaison between the PT IMT and DoT IMT. • Facilitate effective communications and coordination between the PT IC and the DoT IC. • Offer advice to the PT IC on matters pertaining to DoT and wider government incident response policies and procedures. • Facilitate requests for specific tasks from PT IMT related to Aviation and Waste Management.	1
WEL Reputation FST (Media Room)	DoT Media Liaison Officer	DoT	• Provide a direct liaison via Reputation FST Media Team between the PT Media team and DoT IMT Media team. • Facilitate effective communications and coordination between the PT and DoT media teams. • Assist in the release of joint media statements and conduct of joint media briefings. • Assist in the release of joint information and warnings through the DoT Information and Warnings team. • Offer advice to the PT Media Coordinator on matters pertaining to DoT and wider Government media policies and procedures.	1
			Total DoT Personnel Initial Requirement to Woodside	2